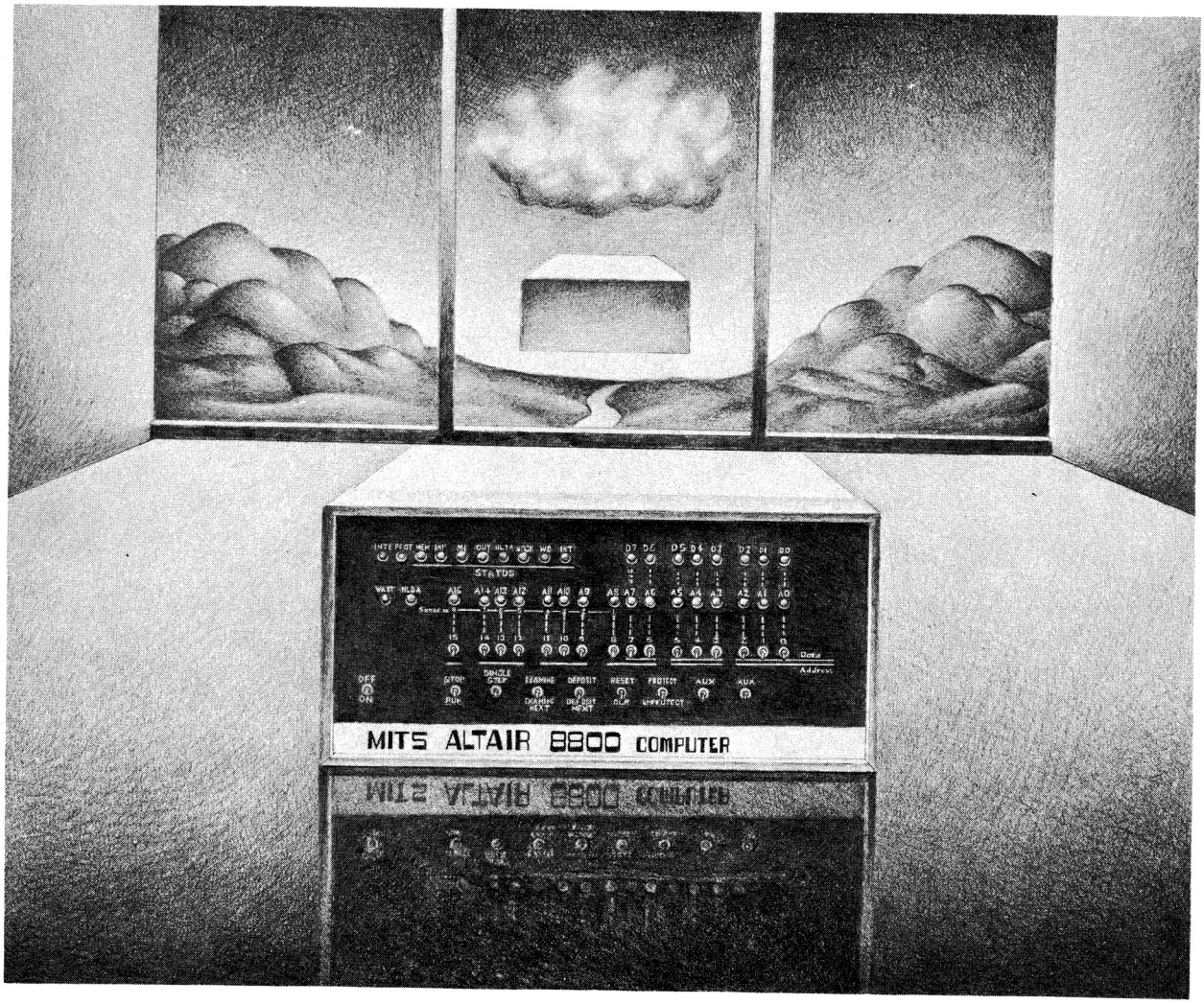
STATUS
MITS ALTAIR 8800 COMPUTER

SERVICE

Should you have a problem with your computer, it can be returned to MITS for repair. If the unit is still under warranty, any defective part will be replaced free of charge. The purchaser is responsible for all postage.

If you return your unit to us for repair, pack it in a sturdy cardboard container and surround it on all sides with a thick layer of packing material. You can use shredded newspaper, foamed plastic or excelsior. The packed carton should be neatly sealed with gummed tape and tied with a stout cord. Be sure to tape a letter containing your name and address, a description of the malfunction, and the original invoice (if the unit is still under warranty) to the outside of the box.

Mail the carton by parcel post or UPS--for extra fast service, ship by air parcel post. Be sure to insure the package.

SHIP TO: MITS, Inc.
6324 Linn Ave. N.E.
Albuquerque, New Mexico 87108

All warranties are void if any changes have been made to the basic design of the machine or if the internal workings have been tampered with in any way.

ALTAIR 8800

ASSEMBLY MANUAL

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"Creative Electronics"
P.O. BOX 8636
ALBUQUERQUE, NEW MEXICO 87108

ASSEMBLY HINTS

Before beginning the construction of your unit, it is important that you read the "Kit Assembly Hints" booklet. Pay particular attention to the section on soldering because most problems in the ALTAIR occur as the result of poor soldering. Failure to heed the warnings in the "Kit Assembly Hints" booklet may cause you to void your warranty.

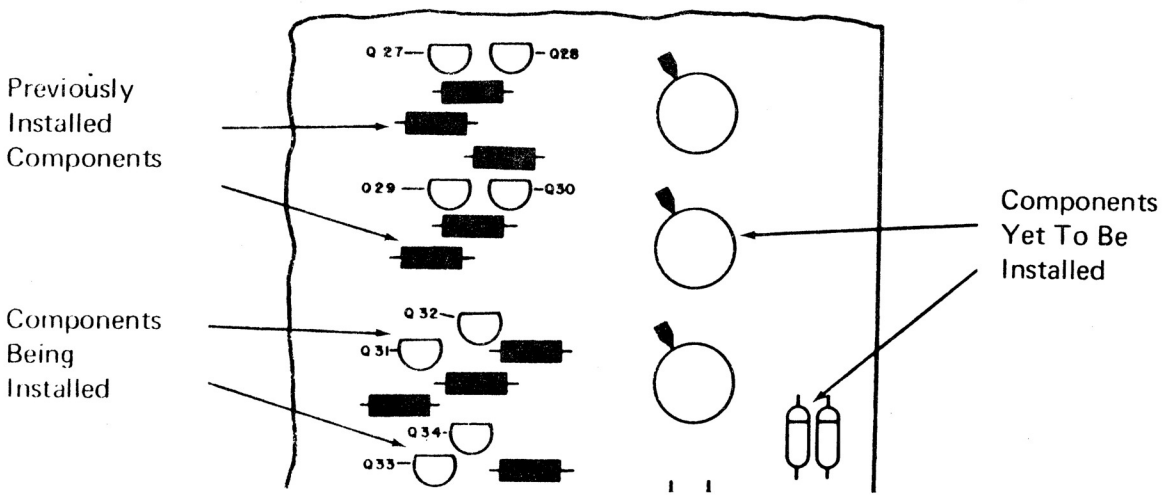
The type of soldering iron used is critical. Use a 30-40 watt iron with a chisel tip, such as an Ungar 776 with a 7155 tip. The delicate soldering necessary for this unit precludes using a blunt-tipped iron.

Each component should be installed in the order presented in the assembly instructions. Each component must be placed in its correct position on the board. There are drawings throughout the assembly instructions which will aid you in installing the components correctly. Some components (diodes, integrated circuits, some capacitors, and transistors) have special orientations on the board. These special orientations are called out in the assembly instructions; it is important that you note them carefully before installing the components.

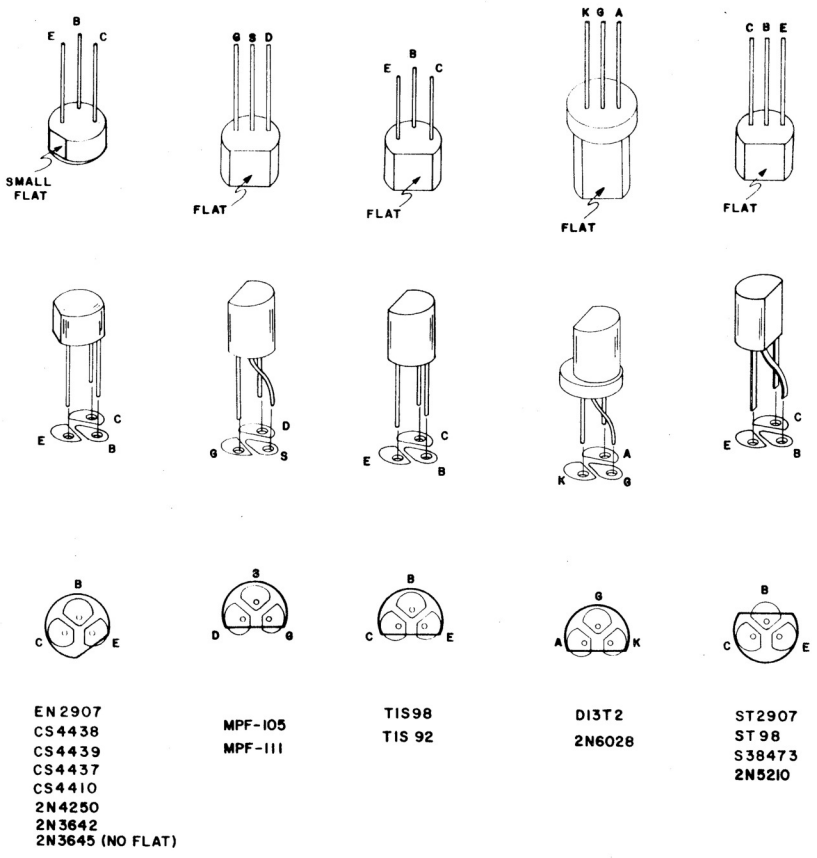
After a component has been soldered to the board, check it off in the space provided on the page. Before going on to a new page, check to make sure all the components on that page have been installed.

Check the contents of your kit against the enclosed parts list to make sure you have all the required components, hardware and parts. The components are in plastic envelopes; do not open them until you need the components for an assembly step. You will need the tools called for in the "Kit Assembly Hints" booklet.

To assist you in assembling your unit, a coding system is used to identify the components already installed, components being installed, and components to be installed later. Compare each page with your circuit board to ensure that all components are installed before going on to a new page.



TRANSISTOR IDENTIFICATION CHART



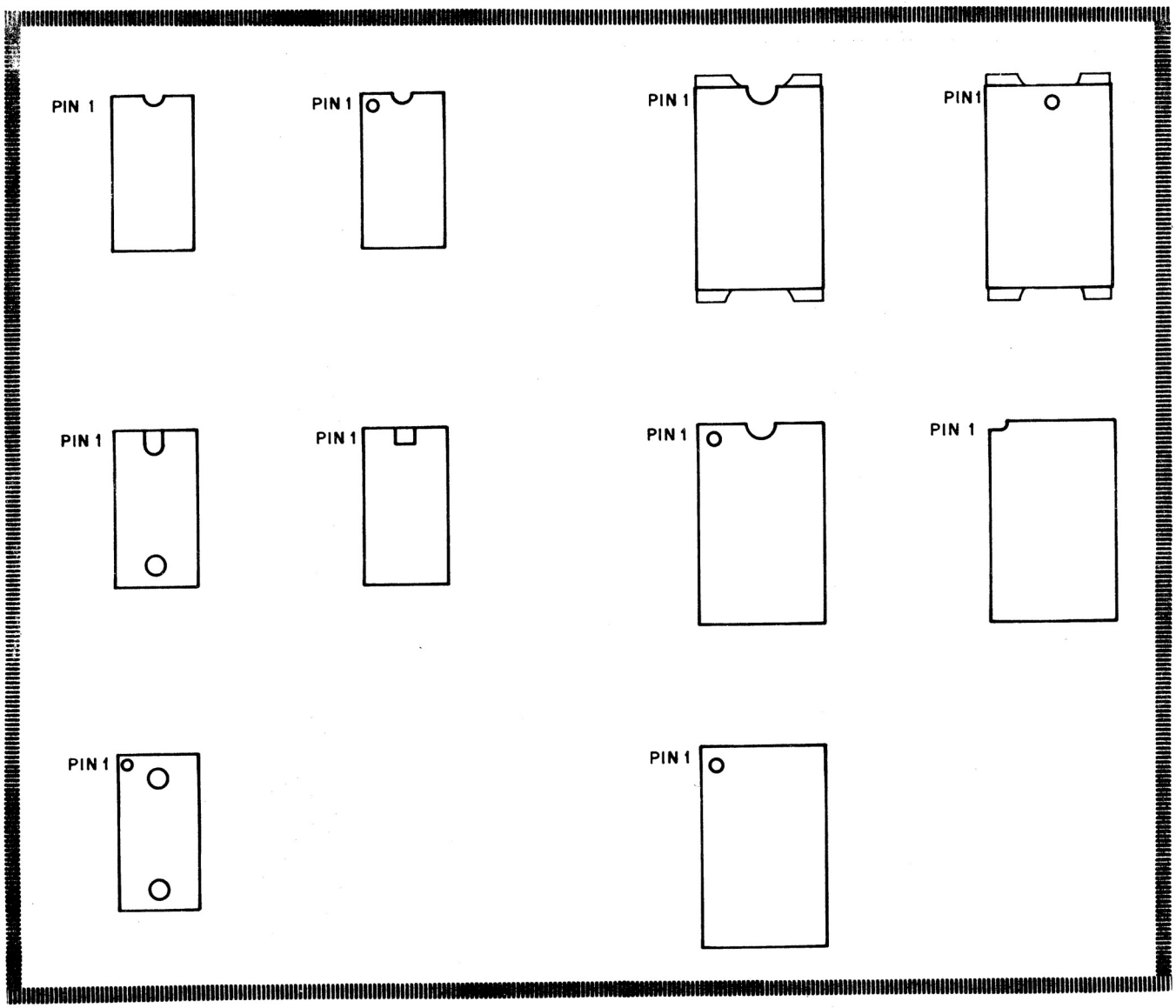
IN THE ILLUSTRATION ABOVE THE OUTLINE OF EACH TYPE OF TRANSISTOR IS SHOWN OVER THE PADS ON THE CIRCUIT BOARD WITH THE CORRECT DESIGNATION FOR EACH OF THE THREE LEADS. USE THIS INFORMATION TOGETHER WITH THE INFORMATION IN THE ASSEMBLY MANUAL FOR THE CORRECT ORIENTATION OF THE TRANSISTORS AS YOU INSTALL THEM.

THE FOLLOWING IS A LIST OF POSSIBLE SUBSTITUTIONS; IF ANY OTHERS ARE USED YOU WILL RISK DAMAGING YOUR UNIT:

CS4410 = CS4437, CS4438, TIS98, ST98, S38473 (NPN)
EN2907 = ST2907, CS4439 (PNP)

FOR SUBSTITUTIONS REFER TO THE INFORMATION ABOVE TO DETERMINE THE CORRECT ORIENTATION FOR THE THREE LEADS.

IC ORIENTATION CHART



INTEGRATED CIRCUITS (IC's) CAN COME WITH ANY ONE OF, OR A COMBINATION OF, SEVERAL DIFFERENT MARKINGS. THESE MARKINGS ARE VERY IMPORTANT IN DETERMINING THE CORRECT ORIENTATION FOR INSTALLATION. REFER TO THE ABOVE DRAWING TO DETERMINE THE POSITION OF PIN 1 OF THE IC AND USE THIS INFORMATION TO ORIENT IT AS DESCRIBED IN THE ASSEMBLY MANUAL.

WARNING: IF THE IC's ARE NOT PROPERLY ORIENTED DURING INSTALLATION, IT MAY RESULT IN PERMANENT DAMAGE TO YOUR UNIT.

MOS IC SPECIAL HANDLING PRECAUTIONS

There are several MOS integrated circuits contained in this kit. These IC's are very sensitive to static electricity and transient voltages. In order to prevent damaging these components, read over the following precautions and adhere to them as closely as possible. FAILURE TO DO SO MAY RESULT IN PERMANENT DAMAGE TO THE IC.

1) All equipment (soldering iron, tools, solder, etc.) should be at the same potential as the PC board, the assembler, the work surface and the IC itself along with its container. This can be accomplished by continuous physical contact with the work surface, the components, and everything else involved in the operation.

2) When handling the IC, develop the habit of first touching the conductive container in which it is stored before touching the IC itself.

3) If the IC has to be moved from one container to another, touch both containers before doing so.

4) Do not wear clothing which will build up static charges. Preferably wear clothing made of cotton rather than wool or synthetic fibers.

5) Always touch the PC board before touching the IC to the board. Try to maintain this contact as much as possible while installing the IC.

6) Handle the IC by the edges. Avoid touching the pins themselves as much as possible.

7) Dry air moving over plastic can build up considerable static charges. Avoid placing the IC near any such area or object.

8) In general, never touch anything to the IC that you have not touched first while touching both it and the IC itself.

8800 DISPLAY/CONTROL BOARD ASSEMBLY

Integrated Circuit Installation

There are 25 integrated circuits (IC's) to be installed on the 8800 Display/ Control Board.

( ) Referring to the component layout, remove the IC with the correct part number from its holder. If there are any bent pins, straighten these using needle-nose pliers. Ensure that you choose the IC with the correct part number as you install each one.

( ) Orient the IC so that its notched end corresponds with the notch printed on the PC Board, and pin 1 of the IC corresponds with the pad marked with an arrowhead on the board.

NOTE: If the IC does not have a notch on one end, refer to the IC Orientation Chart included with your manual for the identification of pin 1.

( ) When you have the correct orientation, start the pins on one side of the IC into their respective holes on the silk-screened side of the PC board. DO NOT PUSH THE PINS IN ALL THE WAY. If you have difficulty getting the pins into the holes, use the tip of a small screwdriver to guide them.

( ) Start the pins on the other side of the IC into their holes in the same manner. When all of the pins have been started, set the IC in place by gently rocking it back and forth until it rests as close as possible to the board. Make sure that the IC is perfectly straight and as close as possible to the board; then tape it in place with a piece of masking tape.

( ) Turn the board over and solder each pin to the foil pattern on the back side of the board. Be sure to solder each pin and be careful not to leave any solder bridges.

( ) Turn the board over again and remove the piece of masking tape.

Use the same procedure to install each of the IC's. Be sure that you have the correct part number and the correct orientation as you install each one.

( ) AA & BB are 74LS04's

( ) Y is a 74L30

( ) U is a 7400

( ) W is a 7404

( ) E is a 7405

( ) B is a 7405

( ) A is a 7405

( ) X is an 8T97

( ) C is a 7405

( ) S & T are 74L10's

( ) D is a 7405

( ) Z is a 74L04

( ) H is a 7400

( ) V is a 7404

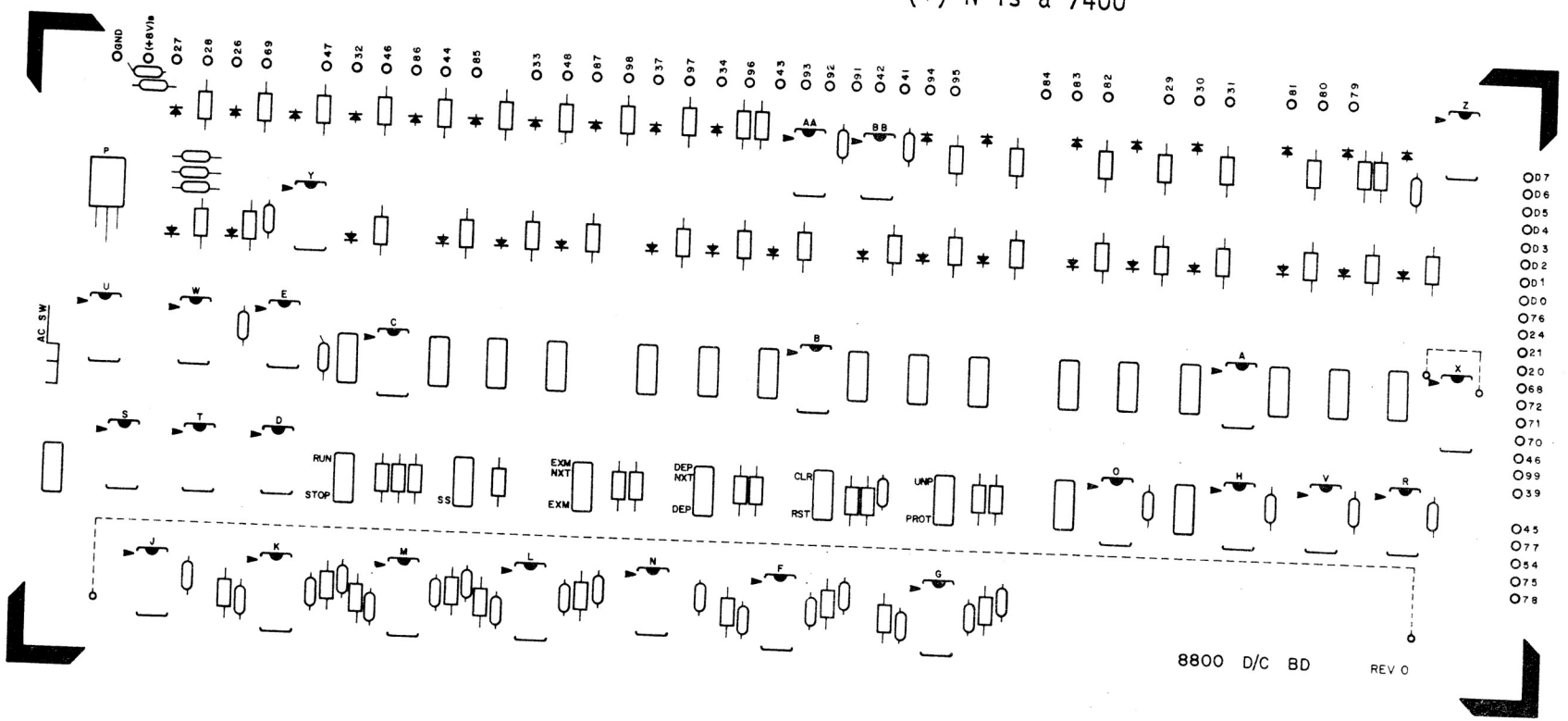
( ) R is a 74L02

( ) O is a 7430

( ) J is a 7473

( ) K, M, L, F and G are 74123's

( ) N is a 7400



Resistor Installation

There are 59 resistors to be installed on the 8800 Display/Control Board.

NOTE: Resistors are color-coded according to their value. The resistors in your kit will have four or possibly five bands of color. The fourth band in both cases will be gold or silver, indicating the tolerance. In the following instructions we will be concerned only with the three bands of color to one side of the gold or silver band. Be sure to match these three bands of color with those called for in the instructions as you install each resistor.

Using needle-nose pliers, bend the leads of the following resistors at right angles to match their respective holes on the PC board. (see component layout)

NOTE: All resistors on the 8800 Display/Control Board are either 1/4 or 1/2 Watt.

( ) Install resistor R1 (1K-ohm, 1/2W, brown-black-red) into the correct holes on the silk-screened side of the PC board.

( ) Holding the resistor in place with one hand, turn the board over and bend the two leads slightly outward.

( ) Solder the leads to the foil pattern on the back side of the board; then clip off any excess lead lengths.

Referring to the component layout, install the remaining resistors in the same manner. Be sure you have the correct color-coding for each one as you install them.

( ) R1, R2, R13, R14, R15, R16, R17, R18, R19, R22 and R34 are all 1K-ohm, 1/2W, brown-black-red.

( ) R3, R5 and R11 are all 47K-ohm, 1/2W, yellow-violet-orange.

( ) R6, R8 and R12 are 7.5K-ohm, 1/2W, violet-green-red.

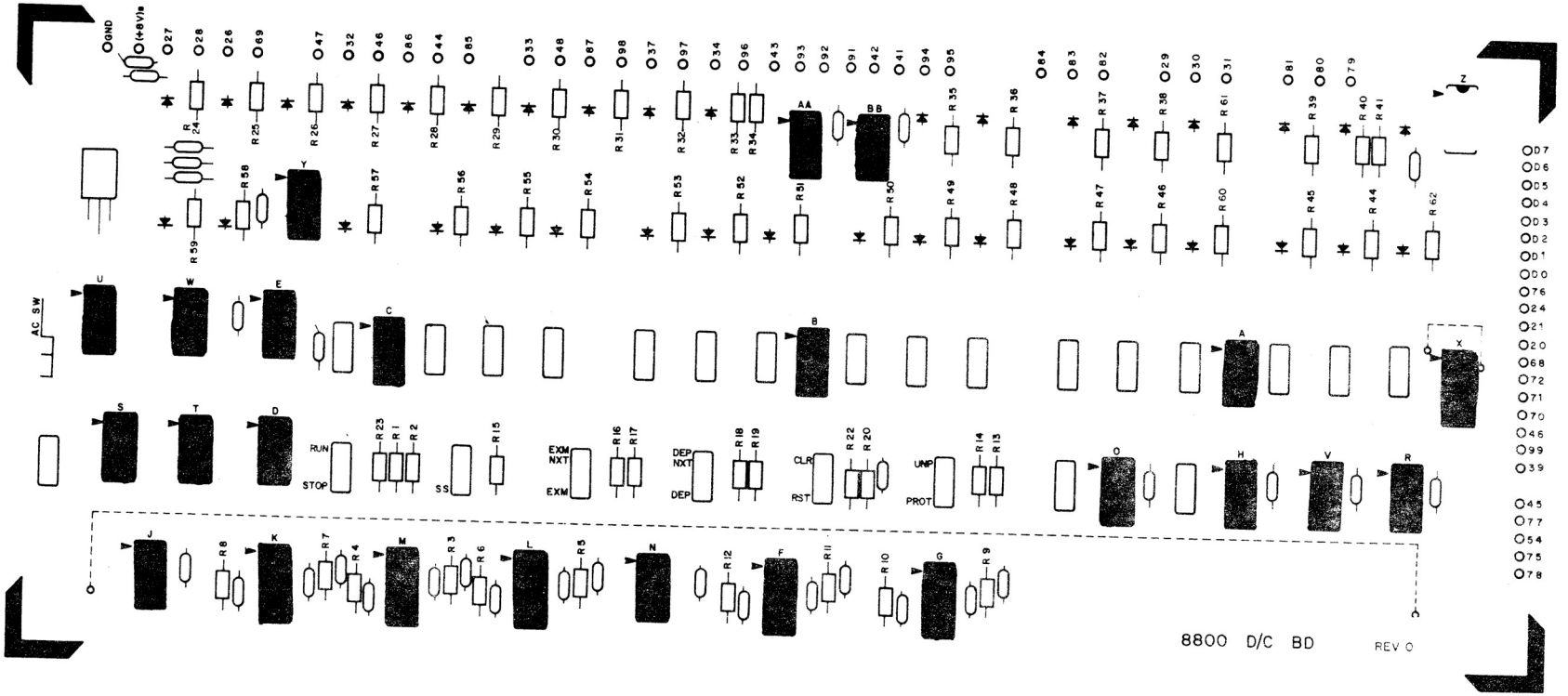
( ) R7, R9 and R10 are all 30K-ohm, 1/2W, orange-black-orange.

( ) R20 is 270K-ohm, 1/2W, red-violet-yellow.

( ) R23 is 100-ohm, 1/2W, brown-black-brown.

( ) R24 to R33, R35 to R41, and R44 to R62 are all 220-ohm, 1/2W, red-red-brown.

( ) R4 is 1/2W, either 20K-ohm (red-black-orange) or 22K-ohm (red-red-orange).



Capacitor Installation

There are 33 ceramic disk capacitors to be installed on the 8800 Display/Control Board.

Refer to the component layout and install the capacitors according to the following procedure.

( ) Choose the capacitor with the correct value as called for in the instructions. Straighten the two leads and bend them as necessary to fit their respective holes on the PC board.

( ) Insert the capacitor into the correct holes from the silk-screened side of the board. Push the capacitor down until the ceramic insulation almost touches the foil pattern.

( ) Holding the capacitor in place, turn the board over and bend the two leads slightly outward.

( ) Solder the two leads to the foil pattern on the back side of the board; then clip off any excess lead lengths.

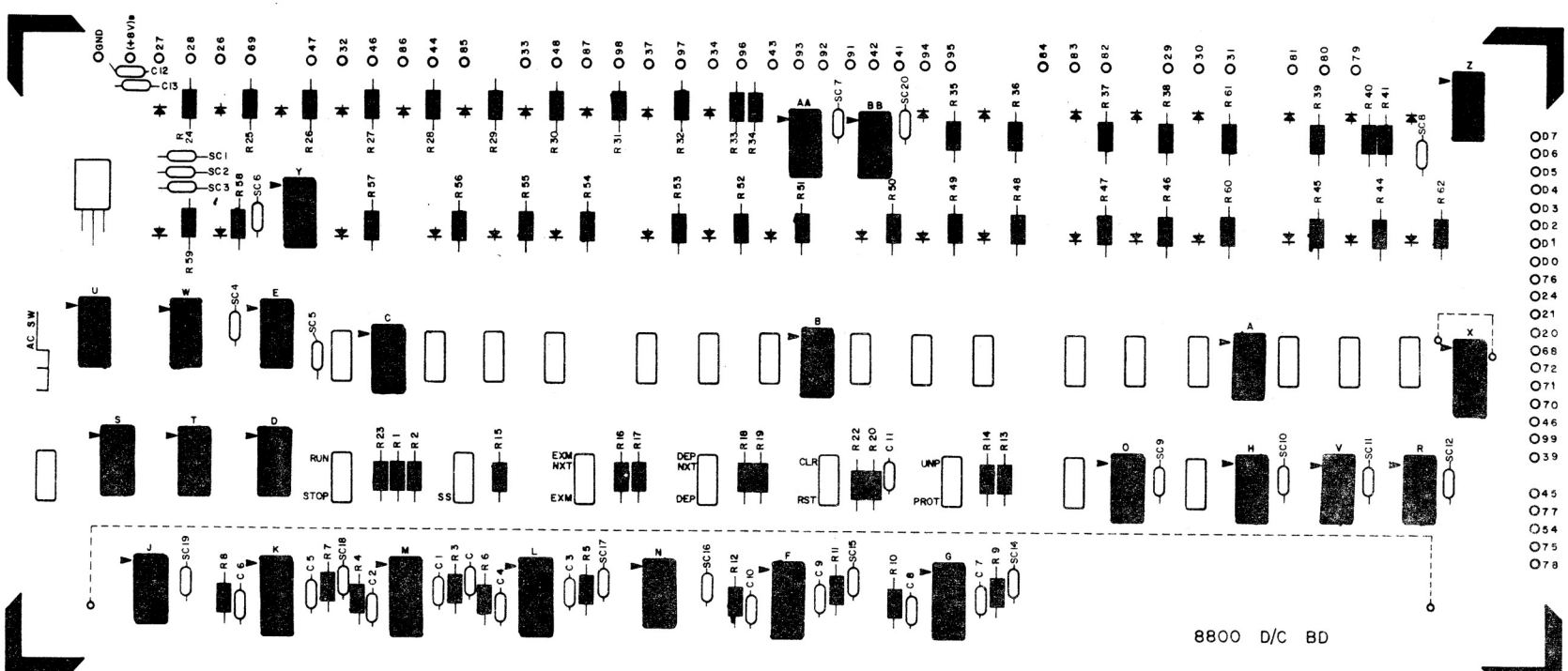
Install all of the capacitors in this manner. Be sure you have the correct value capacitor as you install each one.

( ) C1, C3, C5, C9, C11, C12, C13, and SC1 through SC20 are all .1uf.
NOTE: SC13 is incorrectly marked on the silk-screen; it is the capacitor labeled "c" between R3 & R6.

( ) C2, C4, C6 and C10 are 20pf.

( ) C7 is .001uf.

( ) C8 is .01uf.



Voltage Regulator Installation

There is one MC7805 5-volt regulator to be installed on the 8800 Disply/Control Board.

( ) Set the MC7805 in place on the board and align the mounting holes. (see drawing)

( ) Use a pencil to mark the point on each of the three leads where they line up with their respective holes on the board.

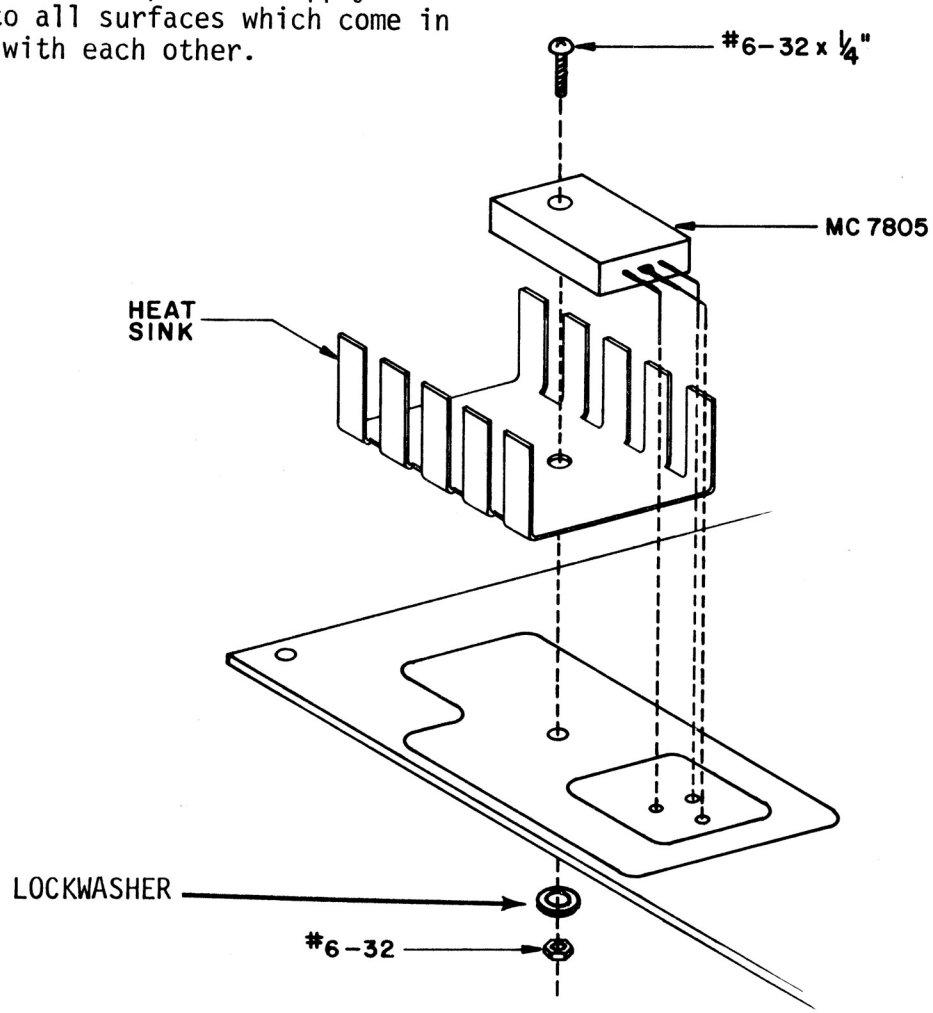
( ) Use needle-nose pliers to bend each of the three leads at a right angle on the points where you made the pencil marks.

NOTE: Use heat-sink grease when installing this component. Apply the grease to all surfaces which come in contact with each other.

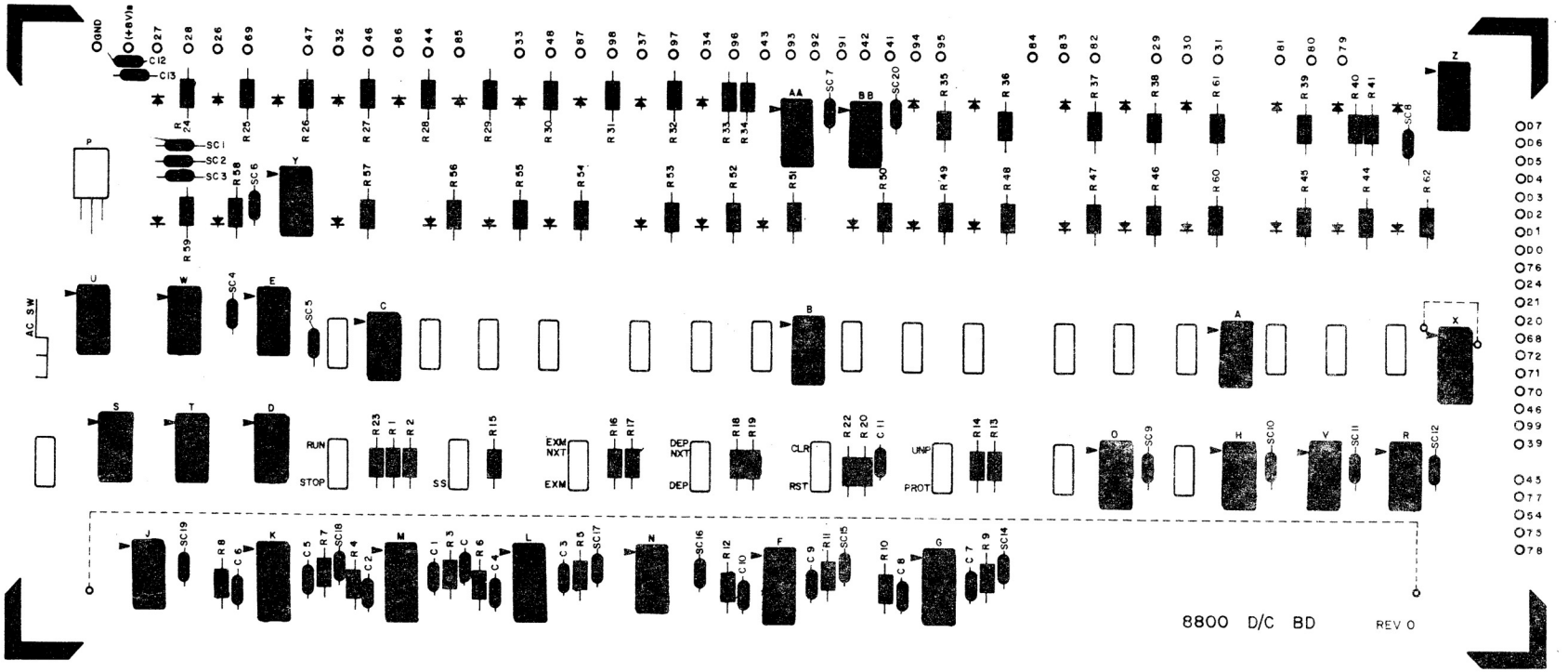
( ) Referring to the drawing, set the regulator and heat sink in place on the silk-screened side of the board. Secure them to the board using a #6-32 nut. Hold the regulator in place as you tighten the nut to keep from twisting the leads.

( ) Turn the board over and solder the three leads to the foil pattern on the back side of the board. Be sure not to leave any solder bridges.

( ) Clip off any excess lead lengths.



( ) Install P (uA7805)



8800 DISPLAY/CONTROL BOARD HARDWIRE CONNECTIONS

There are 62 loose wire connections and 2 jumper wire connections to be made on the 8800 Display/Control Board.

The two jumper connections are to be made by inserting the wires from the silk-screened side of the board and soldering them on the back side. Be sure to clip off any excess lead lengths as you make each connection.

( ) Connect one end of an 18 inch wire to one of the pads labeled "J1".

( ) Cut the wire as necessary so that it is just long enough to reach the other pad labeled "J1" and then solder it to the pad.

( ) Use the length of wire that was cut from the 18 inch wire above to connect both pads labeled "J2". Make this connection in the same manner as that used above.

There are 63 three foot lengths of wire to be connected to the 8800 Display/Control Board.

Make all of these connections by inserting the wires from the back side of the board and soldering them on the silk-screened side. Be sure to clip off any excess lead lengths as you make each connection.

As you install each wire, label the end opposite the connection with a piece of masking tape marked with the same designation as the pad to which it is connected.

NOTE: There are two pads with the designation "46", one on the top edge and one on the side. Only one of these pads need be connected to a wire.

( ) Connect 3 foot wires to the row of 37 pads along the top edge of the board. Start with the pad labeled "GND" and end with the pad labeled "79".

( ) Connect 3 foot wires to the row of 24 pads along the right edge of the board. Start with the pad labeled "D7" and end with the pad labeled "78".

( ) Connect 3 foot wires to the two pads on the left edge of the board labeled "AC SW".

NOTE: There are four heavier guage wires provided for four of the wire connections. Use the heavier #18 wire for the connections to "AC SW", "GND" and "(+8V)B". Use the lighter #26 wire for the other connections.

Component Additions

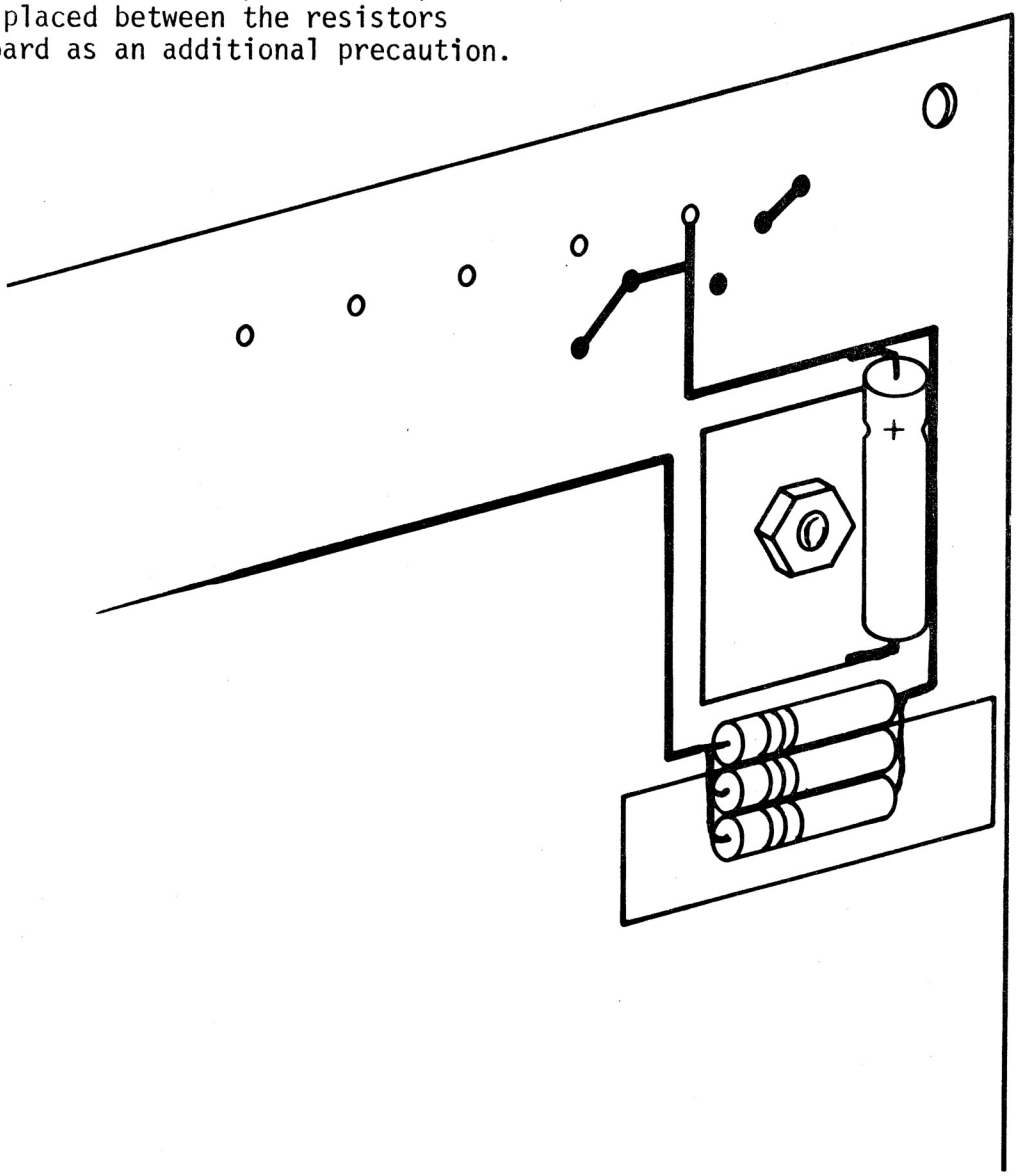
There is one bypass capacitor and three resistors to be mounted on the back (non silk-screened) side of the Display/Control Board.

( ) Referring to the drawing below, connect the capacitor and resistors to the back side of the board as shown.

NOTE: These components are soldered directly to the lands; so be very careful not to leave any solder bridges or shorts between lands. A piece of tape should be placed between the resistors and the board as an additional precaution.

( ) The capacitor can be any value from 20 to 35uf. Observe the polarity orientation indicated in the drawing.

( ) The resistors can be any value from 62 to 68 ohm. These three resistors are to be connected together in parallel as shown before being connected to the board.



Sense Switch Address Wiring

There is one jumper connection to be made on the 8800 Display/Control Board to place the sense switches at address 255.

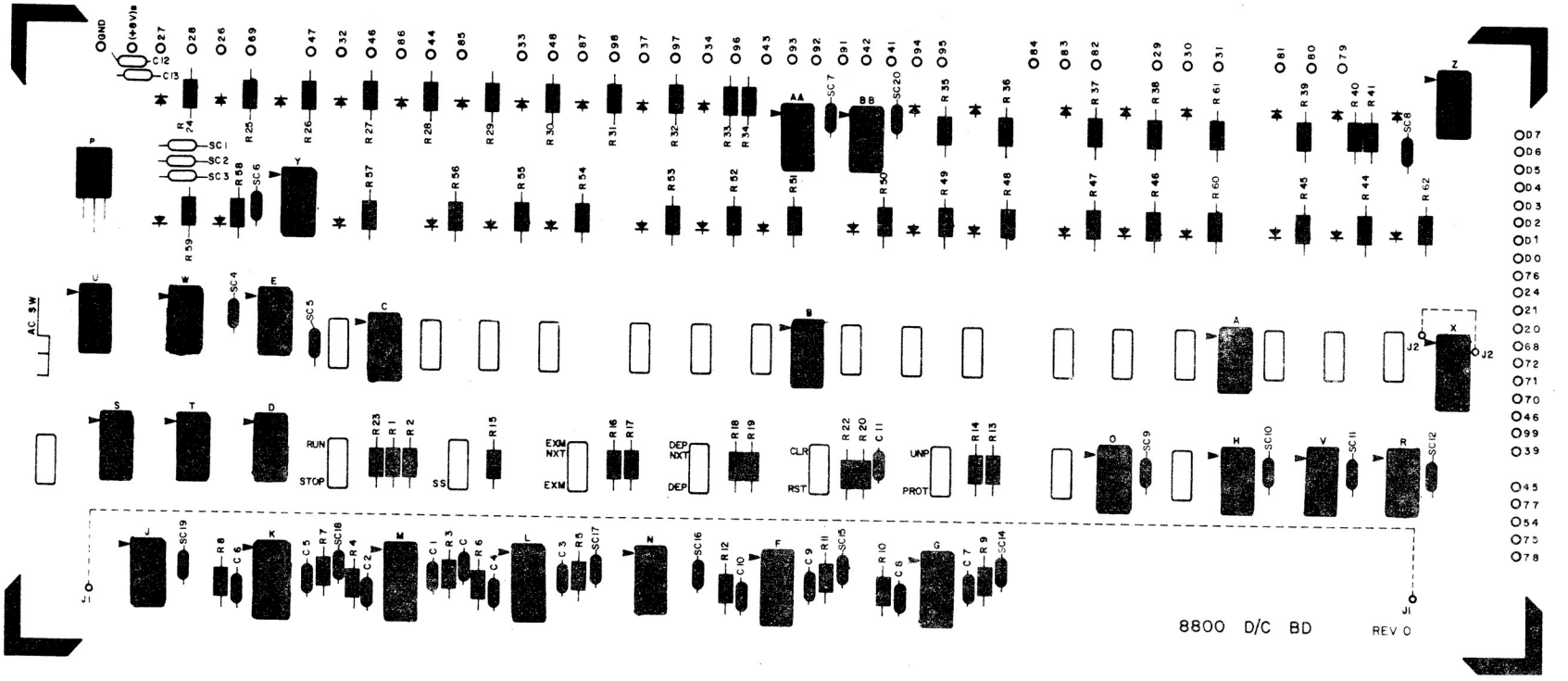
( ) Make this connection in the same manner as jumpers J1 and J2.

( ) The jumper should be connected between the hole just below IC T and the pad just to the left of the unmarked pad between pads 39 and 45 on the right edge of the board.

( ) Connect a 3 foot wire to the unmarked pad mentioned above in the same manner as described on page 14. Label this wire "53".

( ) Install jumpers J1 & J2

( ) Connect 3-foot wires to pads
as instructed on page 14



CHASSIS AND SUB-PANEL REMOVAL

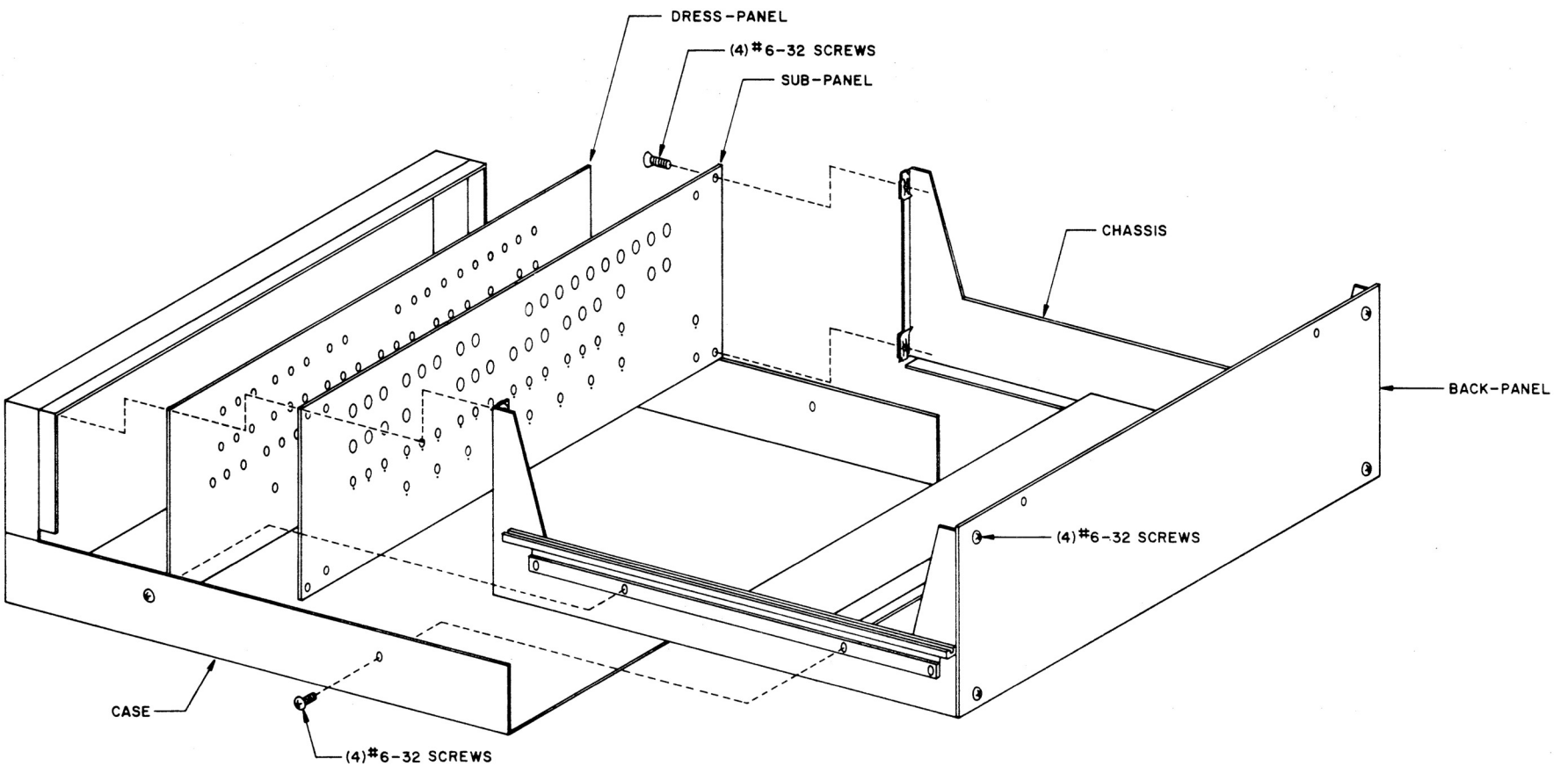
In order to correctly install the LED displays and the switches on the 8800 Display/Control Board, the Sub-Panel must first be removed from the case. The Sub-Panel and Dress-Panel will be used for alignment purposes while installing the remaining components.

(✓) There are four screws securing the chassis to the case bottom, two on each side. Remove these four screws and set them asside. It would be adviseable to place the screws in a small envelope and label it "Chassis Mounting Screws". (see drawing)

( ) Remove the chassis from the case bottom by sliding it towards the back of the case. It will be necessary to lift up on the back of the chassis in order to completely remove it from the case. The Dress-Panel should fall free when the chassis is removed.

( ) There are four screws securing the Sub-Panel to the chassis. Remove these four screws and set them aside.

The chassis and case should now be set out of the way.


DRESS-PANEL
(4) #6-32 SCREWS
SUB-PANEL
CHASSIS
BACK-PANEL
(4) #6-32 SCREWS
CASE
(4) #6-32 SCREWS

Switch Installation

There are 25 toggle switches to be mounted on the 8800 Display/Control Board. Eight of these are momentary contact SPDT switches and seventeen are latching type SPDT switches.

For alignment purposes, the switches must first be mounted to the Sub-Panel before connecting them to the Display/ Control Board itself.

( ) Referring to the drawing, install all 25 switches into the proper holes on the Sub-Panel. Tighten the nuts on the switches just enough to keep the switch from falling off the panel.

NOTE: The momentary contact switches can be distinguished from the latching type switches by their spring action. The momentary contact type will return to the center position automatically when preassure is removed.

( ) The Display/Control Board should now be mounted to the Sub-Panel. Refer to the drawing and mount the board to the panel using #6-32 X 1 inch screws and .6 inch spacers.

NOTE: As the Display/Control Board is set into place with the Sub-Panel it may be necessary to guide the switches into the holes on the board with a screwdriver. The switch leads should protrude approximately 1/8 inch through the PC board.

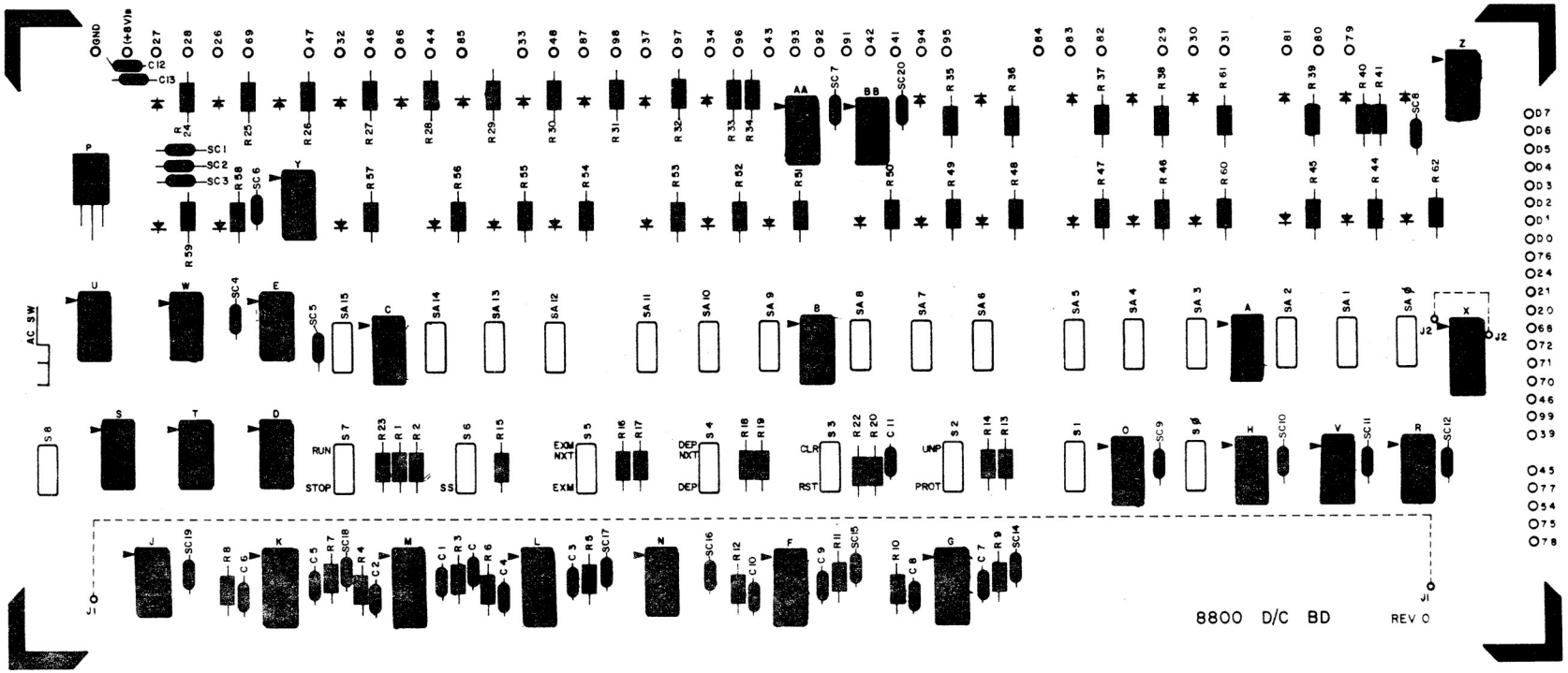
( ) Once the switches are all in place tighten the nuts on all of them so that they are fastened as securely as possible onto the Sub-Panel.

( ) Place the entire assembly in front of you with the PC board facing up.

( ) Solder the leads on each of the 25 switches to the foil pattern on the back side of the board. Be careful not to leave any solder bridges.

( ) Install latching toggle switches SA0 through SA15 and S8.

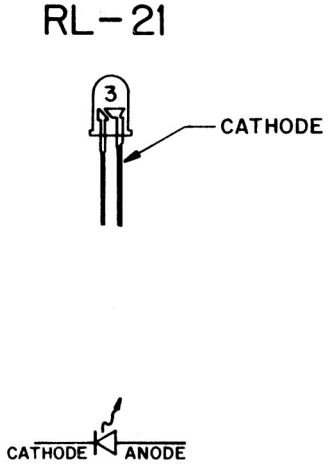
( ) Install momentary contact toggle switches S0 through S7.



LED Installation

There are 36 RL-21 LED's to be installed on the 8800 Display/Control Board. Care must be taken during this procedure to ensure correct physical alignment and polarity orientation.

Refer to the drawing below for the correct polarity orientation of the LED's.



( ) Insert the top row of 18 LED's with the cathode lead towards the top edge of the board. Insert the LED's through the holes on the Sub-Panel into the correct holes on the Display/Control Board. Bend the two leads protruding through the board slightly outward just enough to keep each LED from falling back out. (see drawing)

( ) Insert the second row of 18 LED's in the same manner, but with the cathode lead towards the switches on the bottom. (see drawing)

( ) Referring to the drawing, set the Dress-Panel in place over the Sub-Panel. Secure the two panels together using rubber bands.

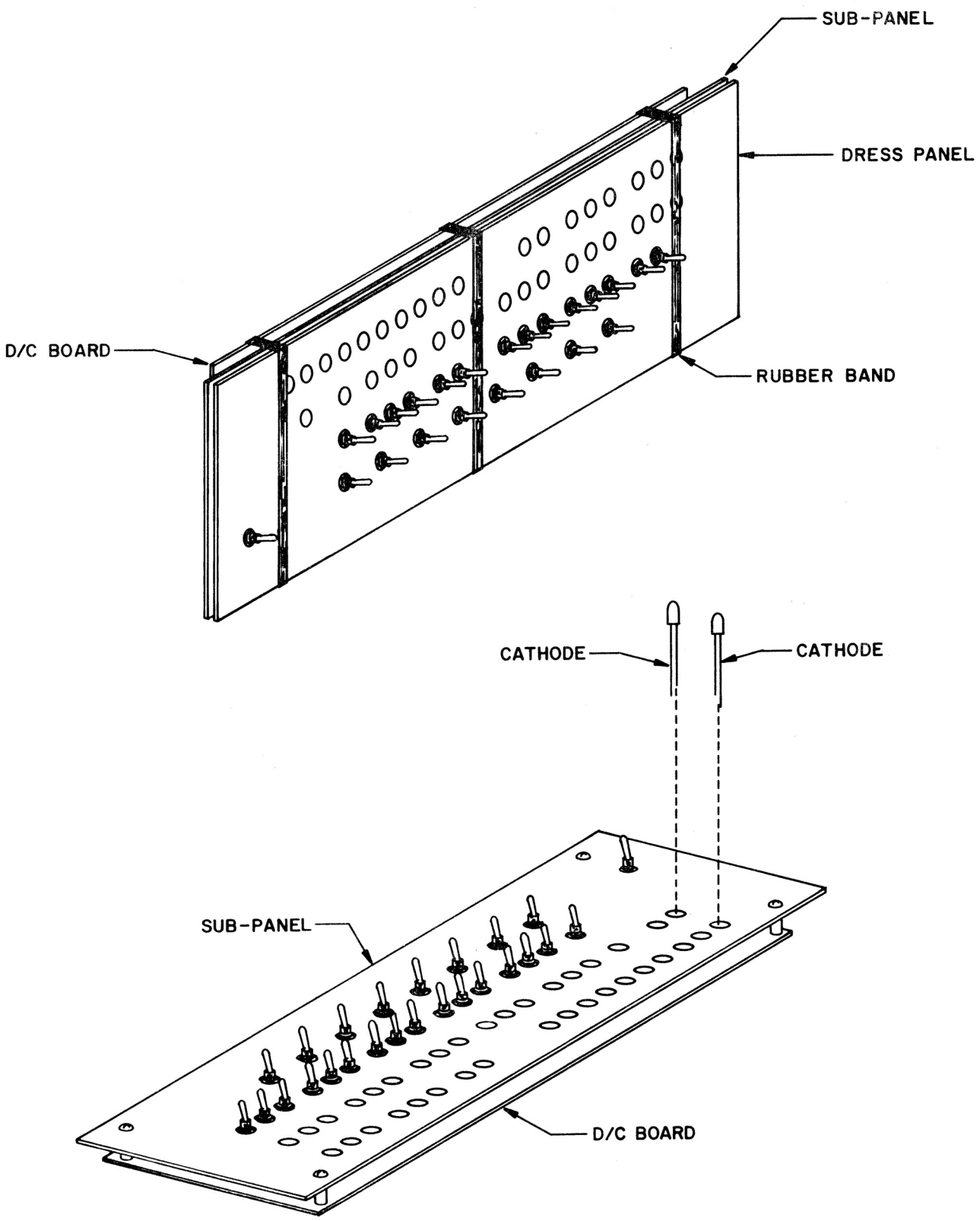
( ) Set the entire assembly in front of you so that you have easy access to both sides.

( ) One at a time, align each LED with the correct hole on the Dress-Panel and solder the two leads to the foil pattern on the back side of the Display/Control Board.

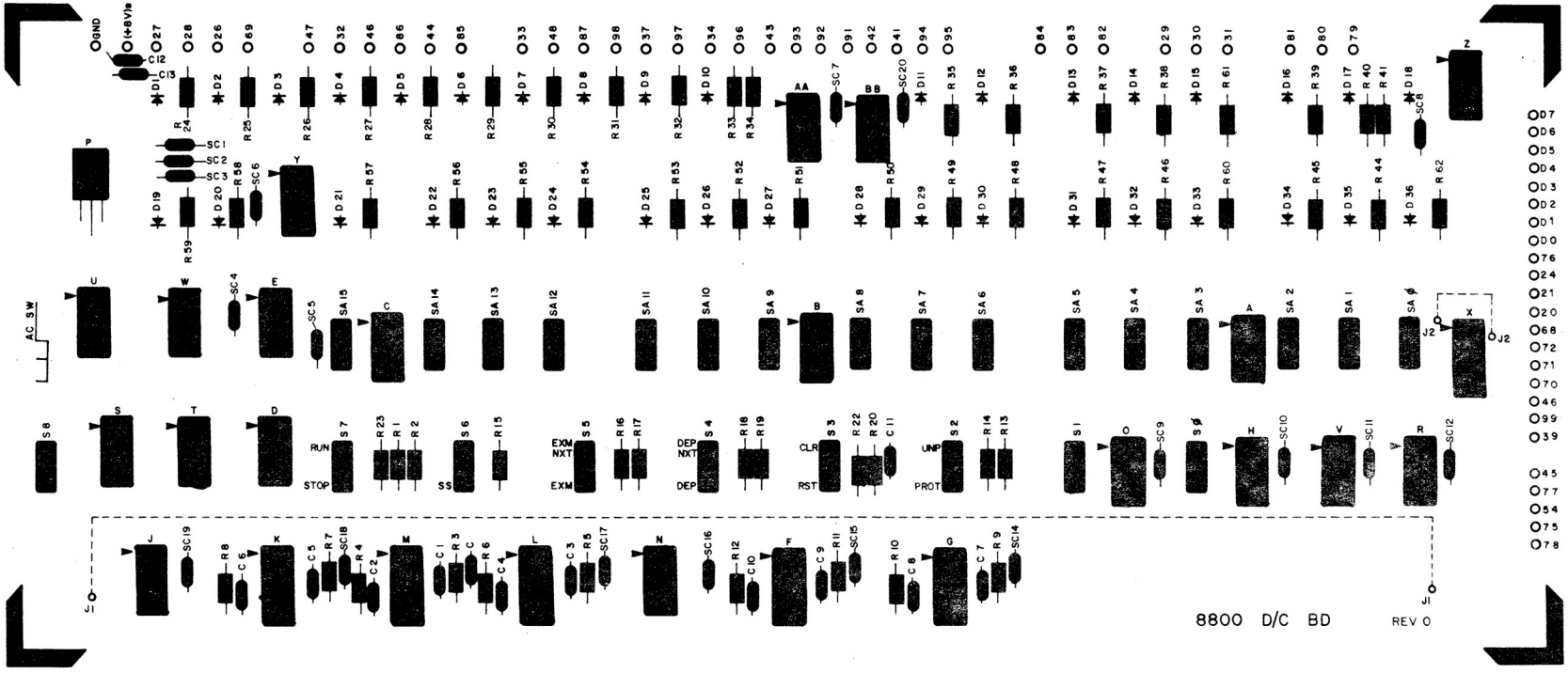
NOTE: Due to supply variations, the LED's in your kit may or may not fit all the way through the holes in the Dress-Panel. If they don't, set them as close as possible to the panel. If they do fit through, set them as desired.

WARNING: These LED's are heat sensitive. Use a minimum amount of heat for a minimum length of time when soldering them.

( ) Clip off any excess lead lengths from each LED after it is soldered into place.


SUB-PANEL
DRESS PANEL
D/C BOARD
RUBBER BAND
CATHODE
CATHODE
SUB-PANEL
D/C BOARD

( ) Install RL-21 LED's D1 through D36.



Connector Plug Installation

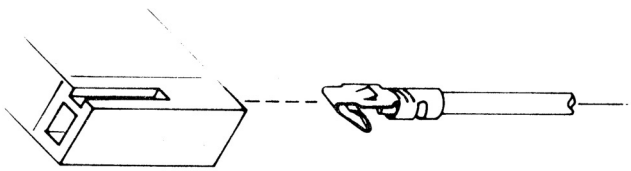
There is one 10-pin female connector to be installed onto 8 of the wires from the 8800 Display/Control Board.

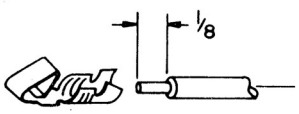
( ) There are 8 wires coming from the row of wires on the shorter edge of the Display/Control board labeled "D0" through "D7". Move the labels on these wires to within 10 inches of the board itself; then cut each of the wires to approximately 16 inches in length.

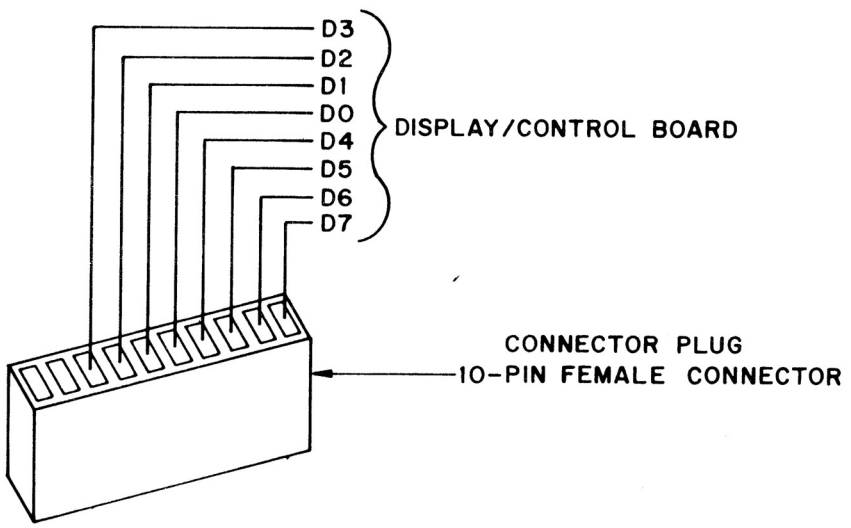
( ) Strip 1/8 inch of insulation from the ends of each of the wires and tin the exposed ends by applying a thin coat of solder.

( ) Install one of the connector pins onto the end of each of the wires. Do this by crimping the wire into place; then soldering the end to the pin itself. (see drawing)

( ) Insert the 8 pins into the 10-pin connector as shown in the drawing below. Be sure that you install them in the order indicated in the drawing.





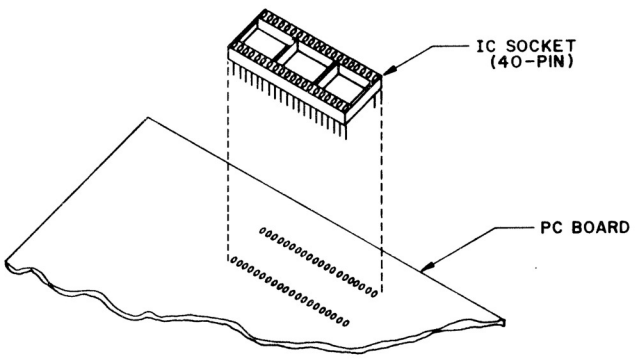


8800 CPU BOARD ASSEMBLY

Integrated Circuit Installation

There are 18 integrated circuits (IC's) to be installed on the 8800 CPU Board. One of these, the 8080 CPU IC, will be provided with a 40-pin IC socket. The 8080 IC itself should not be installed into the socket until the entire board is ready to be installed in the 8800.

( ) Referring to the component layout, set the 40-pin IC socket included in your kit into place, and secure it with a piece of masking tape. (see drawing below)



( ) Turn the board over and solder each pin to the foil pattern on the back side of the board. Be sure to solder each pin and be careful not to leave any solder bridges.

( ) Turn the board over again and remove the masking tape.

( ) Referring to the component layout, remove the IC with the correct part number from its holder. If there are any bent pins, straighten these using needle-nose pliers. Ensure that you choose the IC with the correct part number as you install each one.

( ) Orient the IC so that its notched end corresponds with the notch printed on the PC board, and pin 1 of the IC corresponds with the pad marked with an arrowhead on the board.

NOTE: If the IC does not have a notch on one end, refer to the IC Orientation Chart included with your manual for the identification of pin 1.

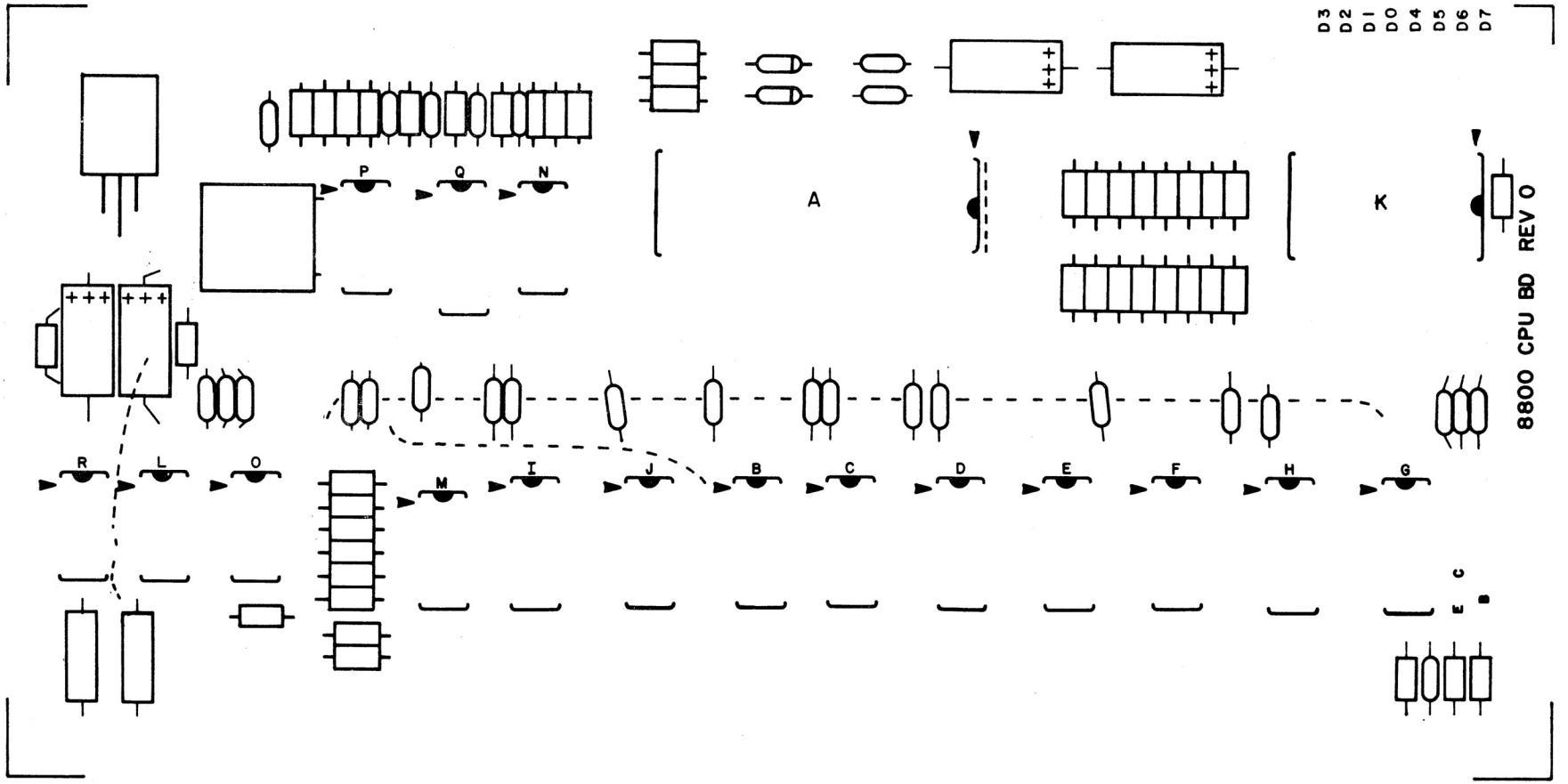
( ) When you have the correct orientation, start the pins on one side of the IC into their respective holes on the silk-screened side of the PC board. DO NOT PUSH THE PINS IN ALL THE WAY. If you have difficulty getting the pins into the holes, use the tip of a small screwdriver to guide them.

( ) Start the pins on the other side of the IC into their holes in the same manner. When all of the pins have been started, set the IC in place by gently rocking it back and forth until it rests as close as possible to the board. Make sure that the IC is perfectly straight and as close as possible to the board; then tape it in place with a piece of masking tape.

( ) Turn the board over and solder each pin to the foil pattern on the back side of the board. Be sure to solder each pin and be careful not to leave any solder bridges.

( ) Turn the board over again and remove the piece of masking tape.

Use the same procedure to install each of the IC's. Be sure that you have the correct part number and the correct orientation as you install each one.



( ) Install a 40-pin socket in IC A position.

( ) K is an 8212

( ) P is a 7404

( ) Q is a 74123

( ) N is a 7406

( ) R is a 74L00

( ) L is a 74LS74 or a 74L74

( ) O is a 74L02

( ) M is a 74LS04

( ) I, J, B, C, D, E, F, H, and G are 8T97's

Hardwire Jumper Connections

There are 5 jumper connections to be made on the 8800 CPU Board.

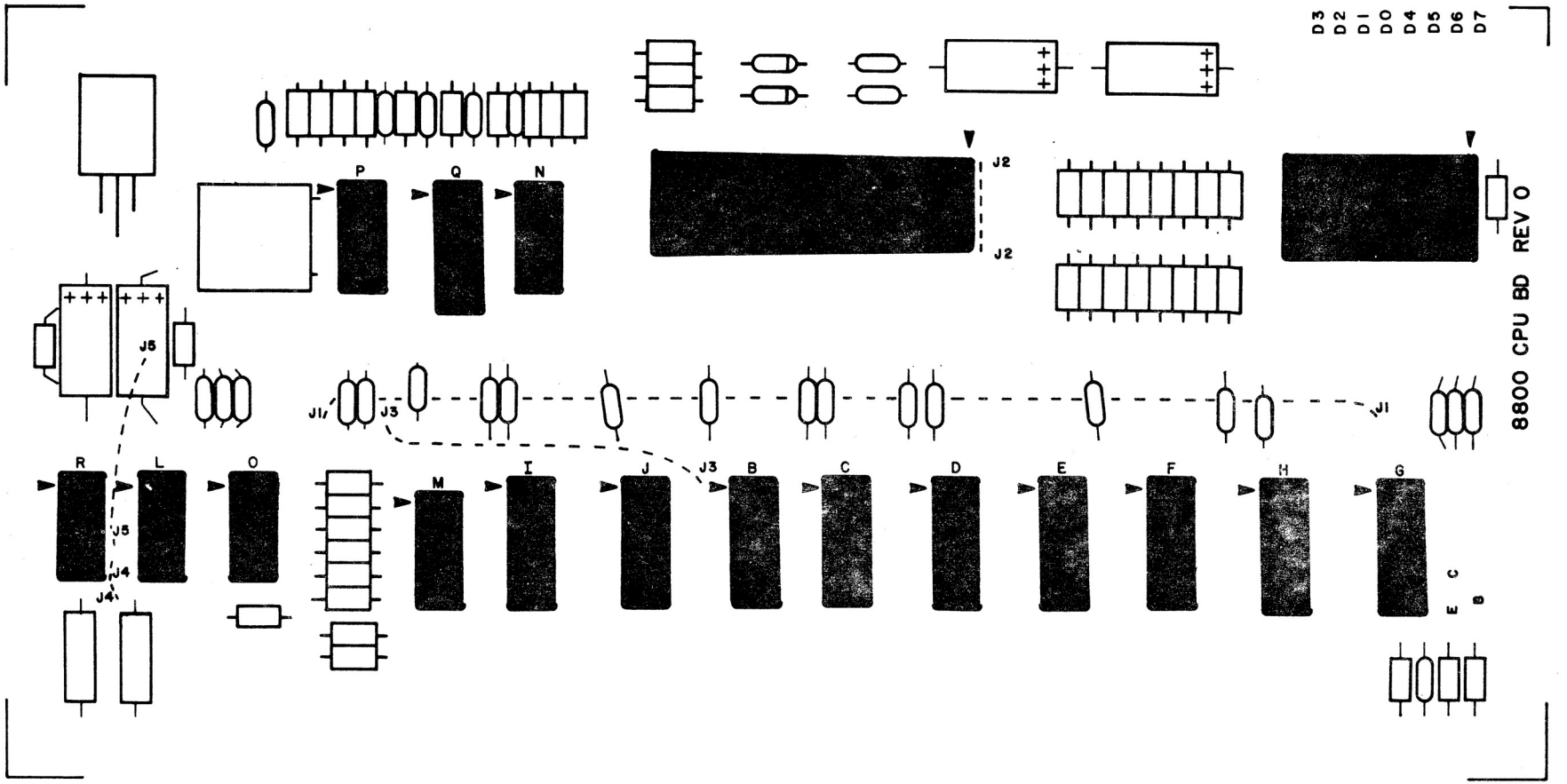
All of the jumper connections on this board are to be made in the same manner. These connections are indicated on the board by two pads marked with the same designation and connected by a broken line. (i.e., J1----------J1)

Use the wire provided in your kit for jumper connections and cut each one to length as needed.

( ) Connect pad J1 to pad J1 by inserting the wire ends from the silk-screened side of the board and soldering them to the foil pattern on the back side. Clip off any excess lead lengths.

( ) Connect J2 to J2 and J3 to J3, etc., in the same manner. Be sure you connect the pads with the same designation each time.

( ) Install jumpers J1 through J5



Resistor Installation

There are 44 resistors to be installed on the 8800 CPU Board.

NOTE: Resistors are color-coded according to their value. The resistors in your kit will have four or possibly five bands of color. The fourth band in both cases will be gold or silver, indicating the tolerance. In the following instructions we will be concerned only with the three bands of color to one side of the gold or silver band. Be sure to match these three bands of color with those called for in the instructions as you install each resistor.

Using needle-nose pliers, bend the leads of the following resistors at right angles to match their respective holes on the PC board. (see component layout)

( ) Install resistor R1 (1K-ohm, 1/2 or 1/4W, brown-black-red) into the correct holes on the silk-screened side of the PC board.

( ) Holding the resistor in place with one hand, turn the board over and bend the two leads slightly outward.

( ) Solder the leads to the foil pattern on the back side of the board; then clip off any excess lead lengths.

Referring to the component layout, install the remaining resistors in the same manner. Be sure you have the correct color-coding for each one as you install them.

( ) R1 to R8, R17 to R25, R35 to R37, R39, and R44 are all 1K-ohm, 1/2W, brown-black-red.

( ) R9 to R16 are 4.7K-ohm, 1/2W, yellow-violet-red.

( ) R26 & R27 are 47K-ohm, 1/2W, yellow-violet-orange.

( ) R28 is 20K-ohm, 1/2W, red-black-orange.

( ) R29, R30, R32 and R33 are 470-ohm, 1/2W, yellow-violet-brown.

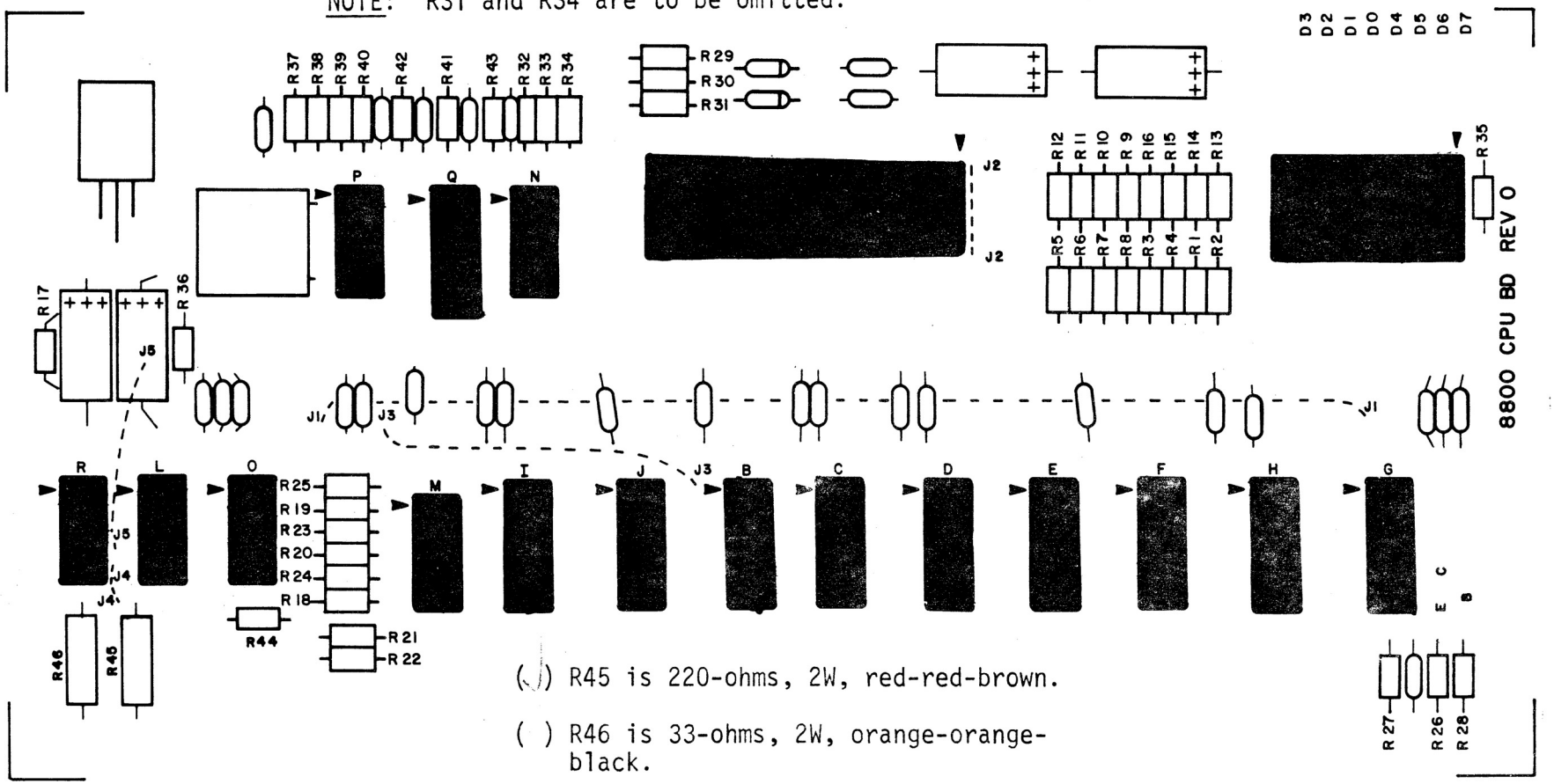
( ) R38 & R40 are 330-ohm, 1/2W, orange-orange-brown.

( ) R41 is 13K-ohm, 1/2W, brown-orange-orange.

( ) R42 is 6.2K-ohm, 1/2W, blue-red-red.

( ) R43 is 680-ohms, 1/2W, blue-gray-brown.

NOTE: R31 and R34 are to be omitted.



( ) R45 is 220-ohms, 2W, red-red-brown.

( ) R46 is 33-ohms, 2W, orange-orange-black.

Capacitor Installation

There are 28 ceramic disk and 4 electrolytic capacitors to be installed on the 8800 CPU Board.

Refer to the component layout and install the ceramic disk capacitors according to the following procedure.

( ) Choose the capacitor with the correct value as called for in the instructions. Straighten the two leads and bend them as necessary to fit their respective holes on the PC board.

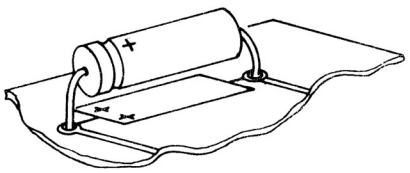
( ) Insert the capacitor into the correct holes from the silk-screened side of the board. Push the capacitor down until the ceramic insulation almost touches the foil pattern.

( ) Holding the capacitor in place, turn the board over and bend the two leads slightly outward.

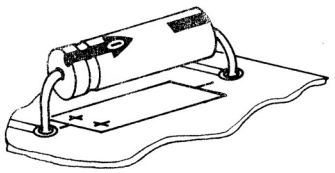
( ) Solder the two leads to the foil pattern on the back side of the board; then clip off any excess lead lengths.

Install all of the ceramic disk capacitors in this manner. Be sure that you have the correct value capacitor as you install each one.

The four electrolytic capacitors for the CPU Board have polarity requirements which must be noted before installation. Those contained in your kit may have one or possibly two of three types of polarity markings. To determine the correct orientation, look for the following: (see drawing above right)



ELECTROLYTIC CAPACITOR



One type will have plus (+) signs on the positive end; another will have a band or a groove around the positive side in addition to the plus signs. The third type will have an arrow on it; in the tip of the arrow there is a negative (-) sign and the capacitor must be oriented so the arrow points to the negative polarity side.

Referring to the component layout, install the electrolytic capacitors on the board.

( ) Bend the two leads of the capacitor with the correct value at right angles to match their respective holes on the board. Insert the capacitor into the holes on the silk-screened side of the board. Be sure to align the positive polarity side with the "+" signs printed on the board.

( ) Holding the capacitor in place, turn the board over and bend the two leads slightly outward. Solder the leads to the foil pattern and clip off any excess lead lengths.

( ) Install the other electrolytic capacitors in the same manner.

( ) C1, C2, C7, C8 and SC1 through SC20 are all .1uf.

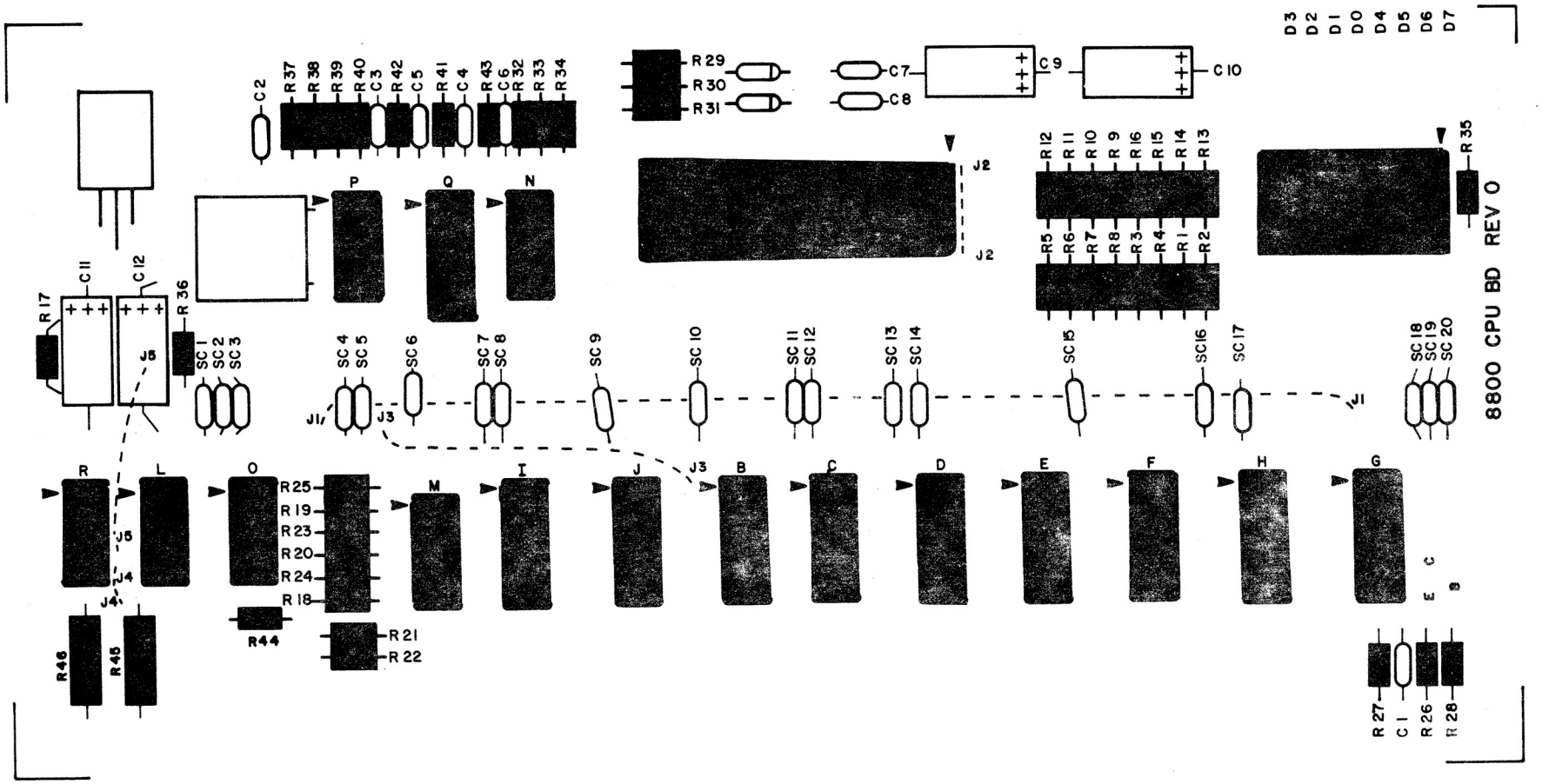
( ) C3 is .01uf.

( ) C4 is 10pf.

( ) C5 is 100pf.

( ) C6 is 20pf.

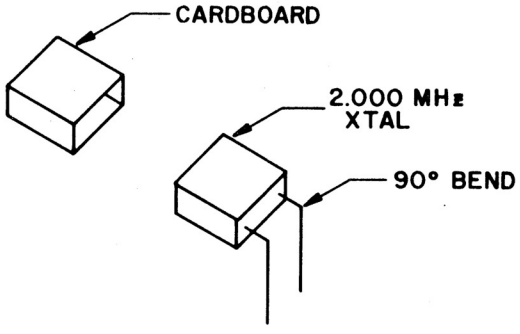
( ) C9 through C12 are all 20uf to 35uf.



Crystal Installation

There is one 2.000MHz crystal to be installed on the 8800 CPU Board.

( ) Referring to the drawing below, cut a piece of the cardboard container that the crystal is packaged in to the same length as the crystal case itself.



( ) Using needle-nose pliers, bend the two leads of the crystal at right angles as in the drawing above.

( ) Insert the crystal into the correct holes from the silk-screened side of the board. (see component layout)

( ) Holding the crystal in place, turn the board over and bend the two leads slightly outward.

( ) Solder the leads to the foil pattern on the back side of the board; then clip off any excess lead lengths.

( ) Place the piece of cardboard over the crystal case as indicated in the drawing.

Zener Diode Installation

There is one 5.1 volt and one 12 volt zener diode to be installed on the 8800 CPU Board.

NOTE: Diodes are marked with a band on one end indicating the cathode end. The diode must be oriented so that the end with the band is towards the band printed on the board when being installed.

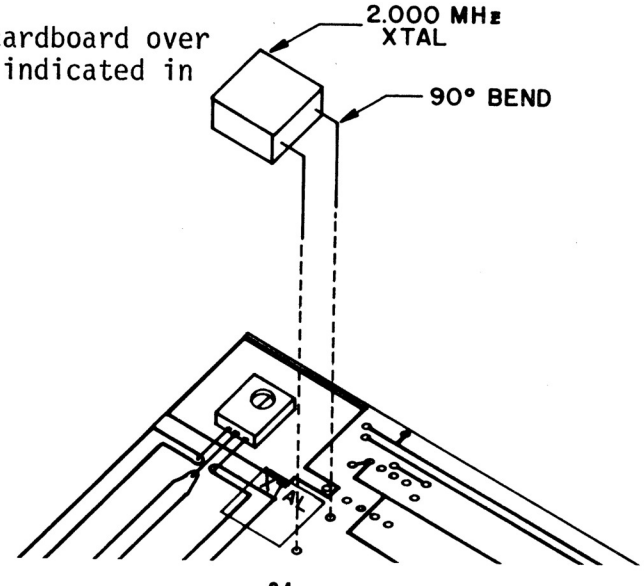
( ) Referring to the component layout, bend the leads on the 12 volt zener at right angles to match the correct holes on the board.

( ) Insert the diode into the correct holes from the silk-screened side of the board. Turn the board over and bend the two leads slightly outward.

( ) Solder the two leads to the foil pattern on the back side of the board; then clip off any excess lead lengths.

( ) Install the 5.1 volt zener diode in the same manner.

Be sure that you have the band on the diode aligned with the band printed on the board for both diodes before proceeding. Failure to orient these two diodes correctly may result in permanent damage to your unit.



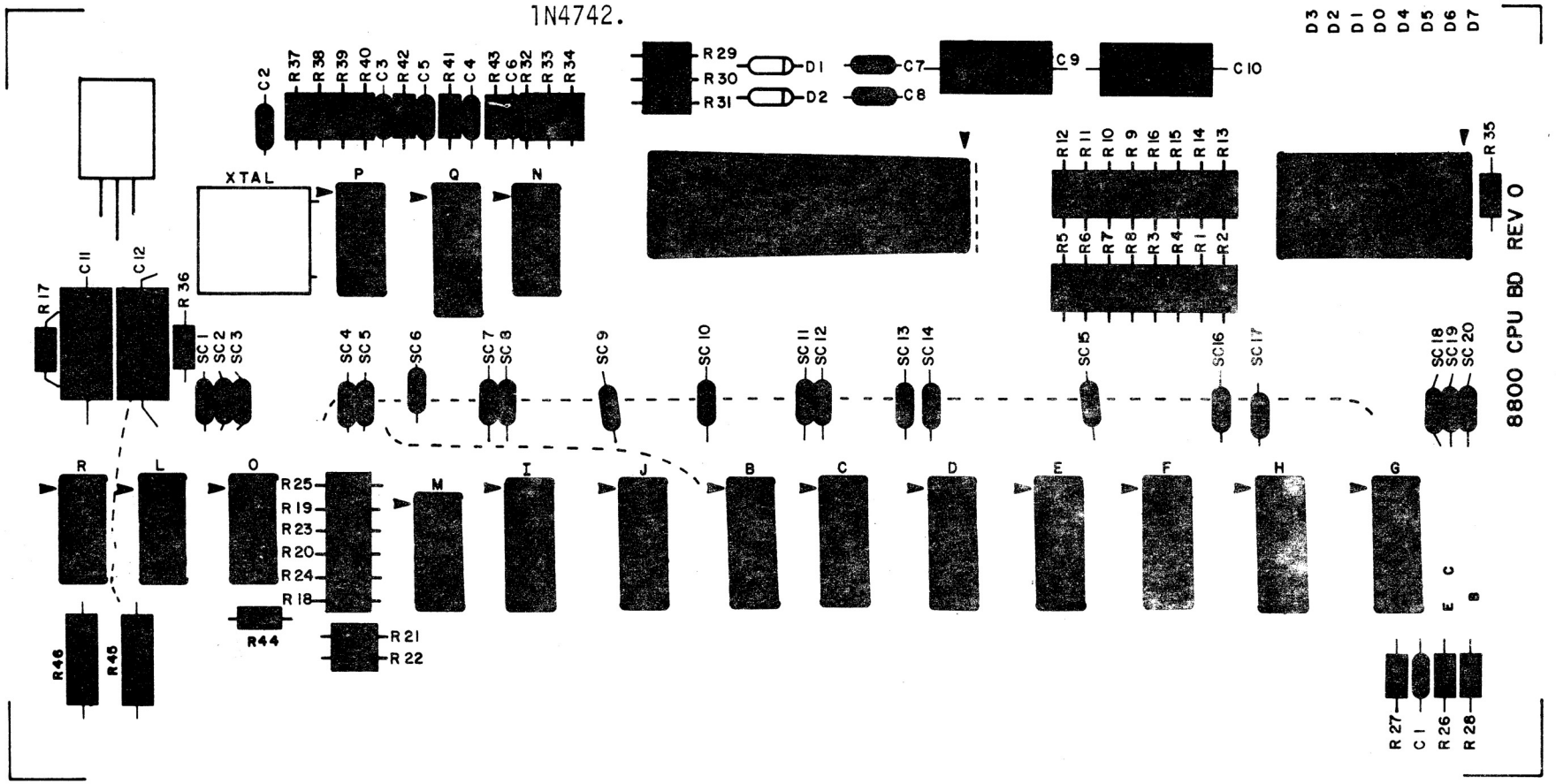
( ) XTAL is a 2.000MHz crystal.

( ) D1 is a 12v zener diode.

( ) D2 is a 5.1v zener diode.

The 5v zener will be marked "5v", "5.1v" or 1N4733.

The 12v zener will be marked "12v" or 1N4742.

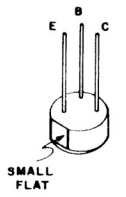


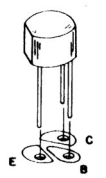
Transistor Installation

There is one CS4410 NPN transistor to be installed on the 8800 CPU Board.

NOTE: When installing this transistor, ensure that you check the part number on it before soldering it into place. Some transistors are identical in physical appearance but differ in electrical characteristics. If the part numbers of your transistors do not match the numbers called for in the instructions, it may be that you have substitutions. In this case, refer to the Transistor Identification Chart included with your manual.

( ) This transistor is rounded and has a flat edge near one of the leads. The lead nearest this flat edge is called the emitter. The hole for the emitter is marked with an "E" on the board. If the emitter lead is placed into this hole, the other two leads should fit into their holes with little or no bending and should not cross over each other. (see drawing below)





( ) Orient transistor Q1 (CS4410) so that the lead nearest the flat edge aligns with the hole marked "E" on the board. Insert the transistor into the holes from the silk-screened side of the board.

( ) Holding the transistor in place, turn the board over and bend the three leads slightly outward.

( ) Solder the leads to the foil pattern on the back side of the board; then clip off any excess lead lengths.

Voltage Regulator Installation

There is one MC7805 5-volt regulator to be installed on the 8800 CPU Board.

( ) Set the MC7805 in place on the board and align the mounting holes. (see drawing)

( ) Use a pencil to mark the point on each of the three leads where they line up with their respective holes on the board.

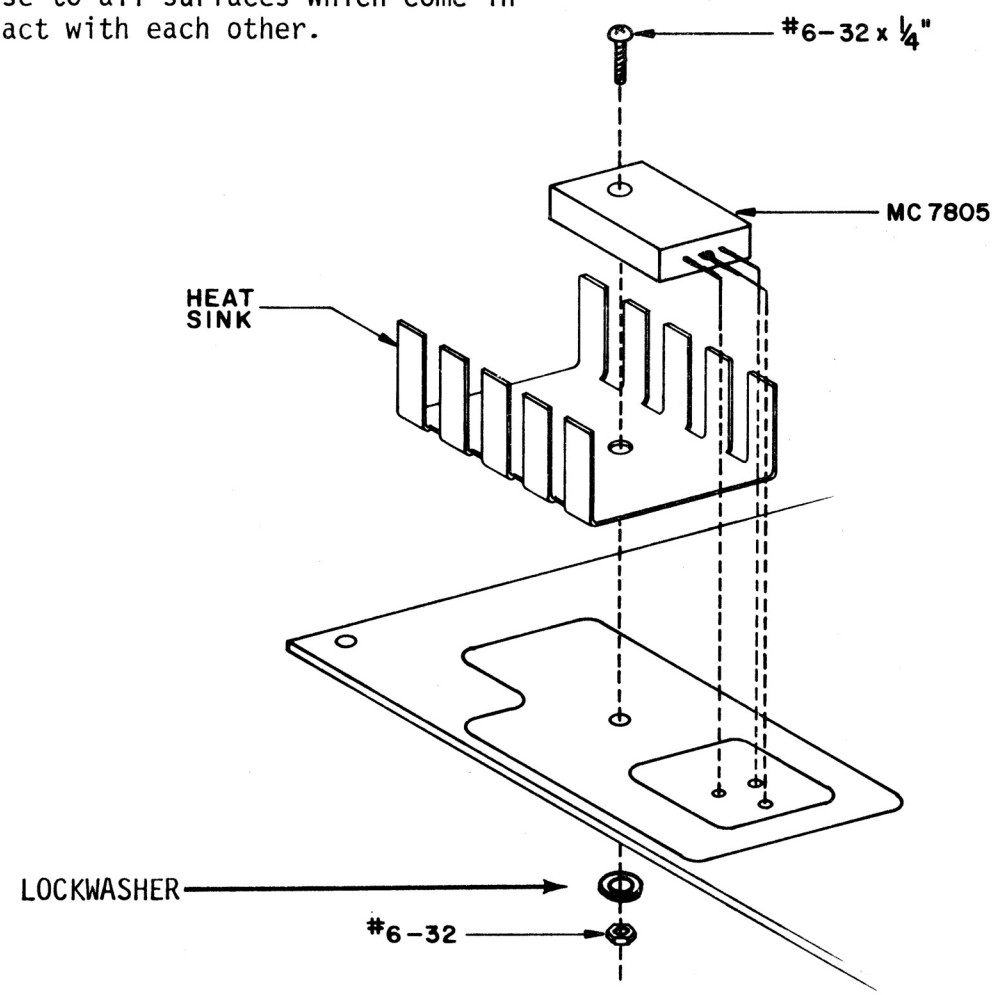
( ) Use needle-nose pliers to bend each of the three leads at a right angle on the points where you made the pencil marks.

NOTE: Use heat-sink grease when installing this component. Apply the grease to all surfaces which come in contact with each other.

( ) Referring to the drawing, set the regulator and heat sink in place on the silk-screened side of the board. Secure them to the board using a #6-32 nut. Hold the regulator in place as you tighten the nut to keep from twisting the leads.

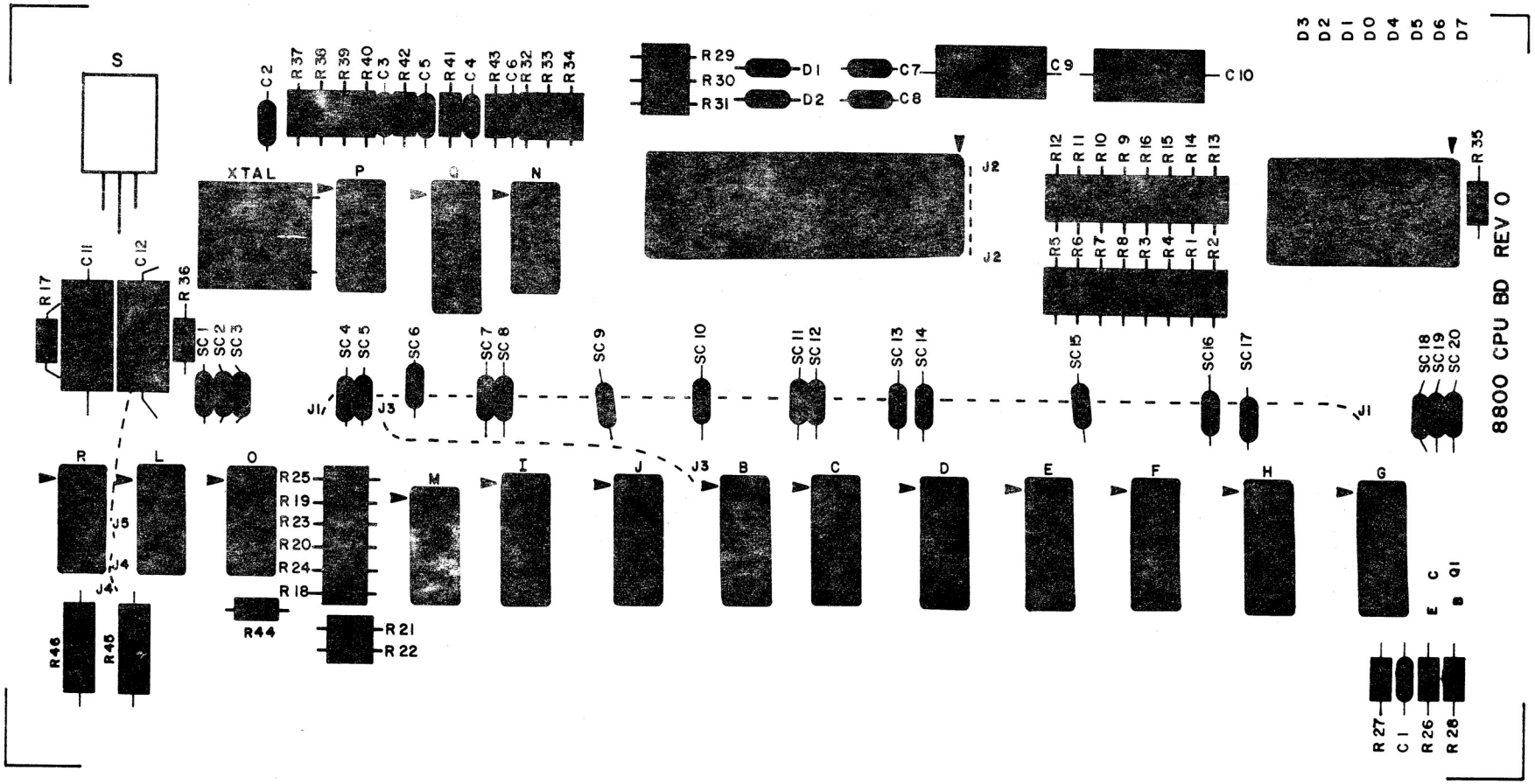
( ) Turn the board over and solder the three leads to the foil pattern on the back side of the board. Be sure not to leave any solder bridges.

( ) Clip off any excess lead lengths.



( ) Q1 is a CS4410, NPN transistor.

( ) S is a uA7805

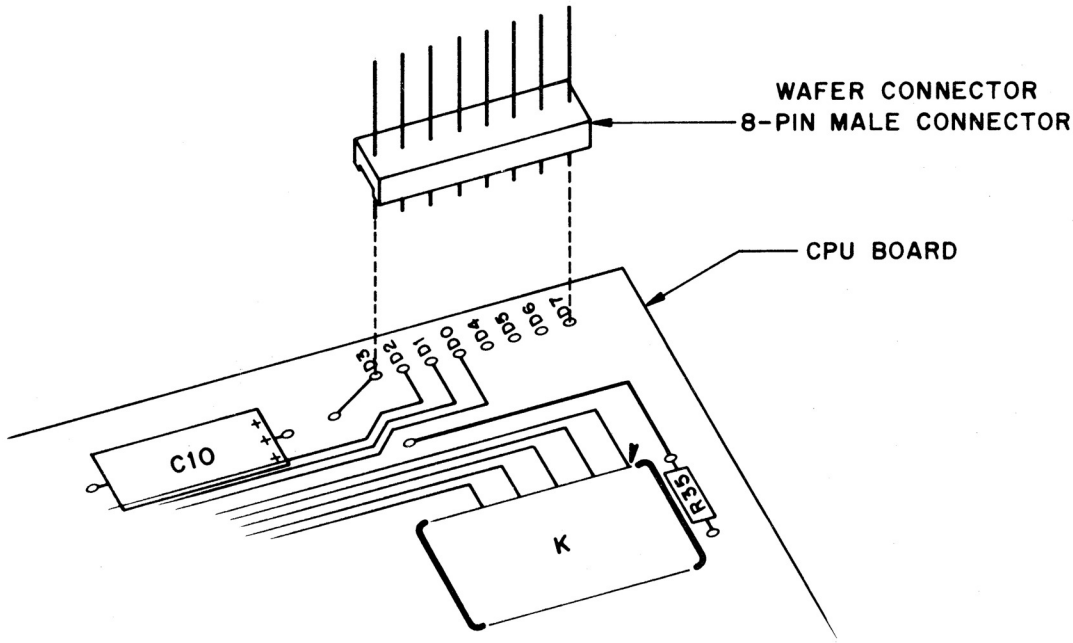


Wafer Connector Installation

There is one 8-pin male connector to be installed on the 8800 CPU Board.

( ) Referring to the drawing below, insert the 8-pin wafer connector into the correct holes on the board from the silk-screened side. Be sure to insert the side with the shorter pins.

( ) Holding the connector in place, turn the board over and solder the 8 pins to the foil pattern on the back side of the board.



1K STATIC MEMORY BOARD ASSEMBLY

Integrated Circuit Installation

There are 20 integrated circuits (IC's) to be installed on the 8800 1K Static Memory Board. Some of these are MOS IC's and are very sensitive to static electricity and transient voltages. Read the MOS IC Special Handling Precautions sheet included with your manual before proceeding.*

( ) Referring to the component layout, remove the IC with the correct part number from its holder. If there are any bent pins, straighten these using needle-nose pliers. Ensure that you choose the IC with the correct part number as you install each one.

( ) Orient the IC so that its notched end corresponds with the notch printed on the PC board, and pin 1 of the IC corresponds with the pad marked with an arrowhead on the board.

NOTE: If the IC does not have a notch on one end, refer to the IC Orientation Chart included with your manual for the identification of pin 1.

( ) When you have the correct orientation, start the pins on one side of the IC into their respective holes on the silk-screened side of the PC board. DO NOT PUSH THE PINS IN ALL THE WAY. If you have difficulty getting the pins into the holes, use the tip of a small screwdriver to guide them.

( ) Start the pins on the other side of the IC into their holes in the same manner. When all of the pins have been started, set the IC in place by gently rocking it back and forth until it rests as close as possible to the board. Make sure that the IC is perfectly straight and as close as possible to the board; then tape it in place with a piece of masking tape.

( ) Turn the board over and solder each pin to the foil pattern on the back side of the board. Be sure to solder each pin and be careful not to leave any solder bridges.

( ) Turn the board over again and remove the piece of masking tape.

Use the same procedure to install each of the IC's. Be sure that you have the correct part number and the correct orientation as you install each one.

* The basic 8800 kit is provided with 256 words of memory. This means that only two 8101 IC's are used. Install these two in positions MA1 & MA2. Each additional 256 word block of memory is installed in the same manner; i.e. MB1 & MB2, MC1 & MC2, MD1 & MD2.

(✓) MA1 & MA2 through MD1 & MD2 are 8101 static RAM's.

( ) J & H are 8T97's

( ) D & N & L are 74L00's

(✓) F is a 7400 or a 74L00

(✓) C & A are 74L04's

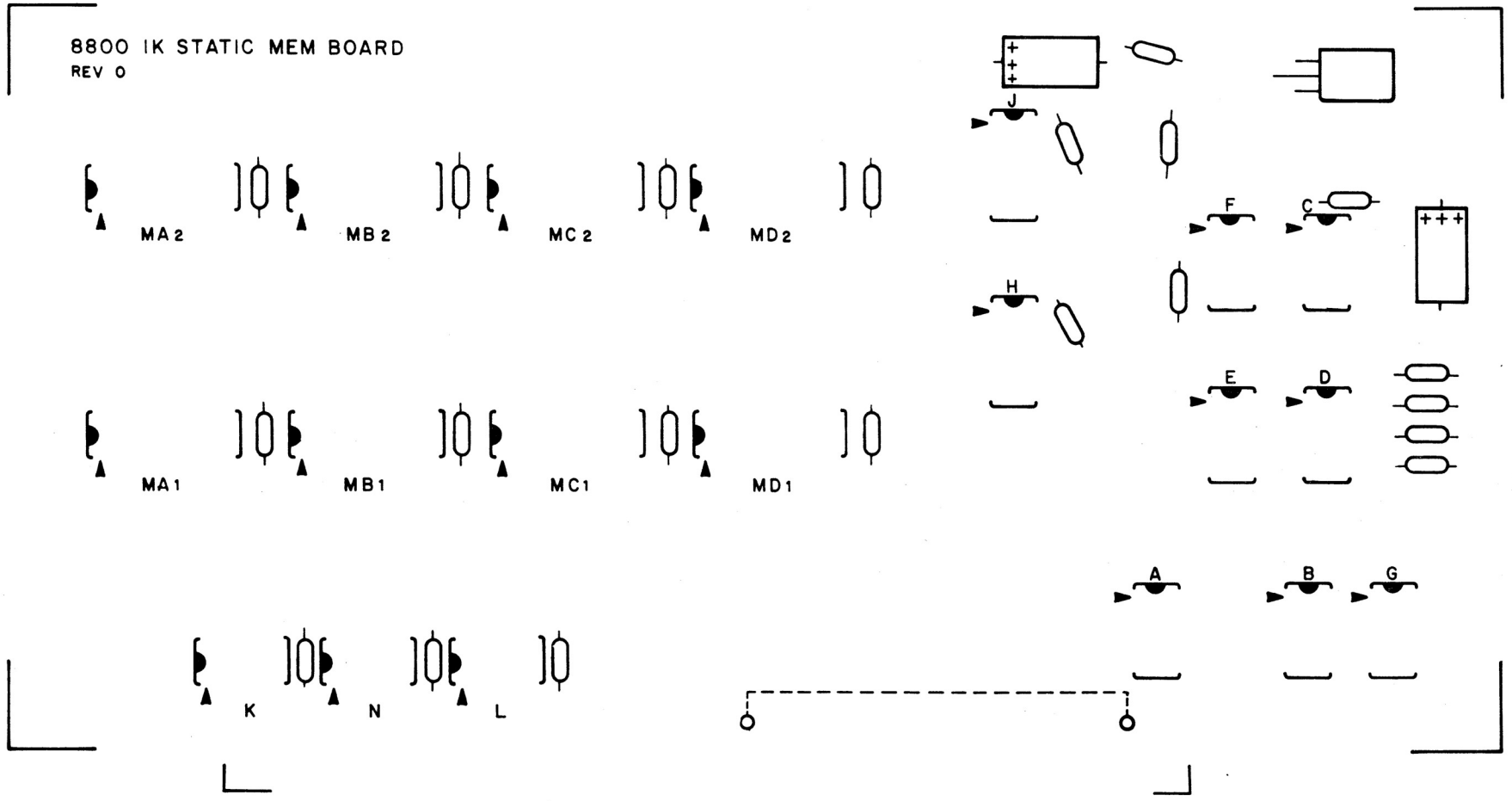
( ) E is a 7404

( ) K is a 74L73

( ) B is a 74L30

( ) G is a 7432

8800 IK STATIC MEM BOARD
REV 0



Capacitor Installation

There are 21 ceramic disk and 2 electrolytic capacitors to be mounted on the 8800 1K Static Memory Board.

Refer to the component layout and install the ceramic disk capacitors according to the following procedure.

( ) Choose the capacitor with the correct value as called for in the instructions. Straighten the two leads and bend them as necessary to fit their respective holes on the PC board.

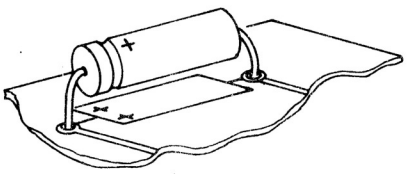
( ) Insert the capacitor into the correct holes from the silk-screened side of the board. Push the capacitor down until the ceramic insulation almost touches the foil pattern.

( ) Holding the capacitor in place, turn the board over and bend the two leads slightly outward.

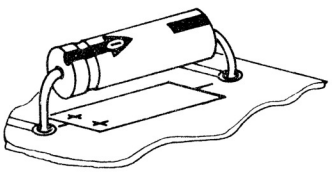
( ) Solder the two leads to the foil pattern on the back side of the board; then clip off any excess lead lengths.

Install all of the ceramic disk capacitors in this manner. Be sure that you have the correct value capacitor as you install each one.

The two electrolytic capacitors for the memory board have polarity requirements which must be noted before installation. Those contained in your kit may have one or possibly two of three types of polarity markings. To determine the correct orientation, look for the following: (see drawing above right)



ELECTROLYTIC CAPACITOR



One type will have plus (+) signs on the positive end; another will have a band or a groove around the positive side in addition to the plus signs. The third type will have an arrow on it; in the tip of the arrow there is a negative (-) sign and the capacitor must be oriented so the arrow points to the negative polarity side.

Referring to the component layout, install the electrolytic capacitors on the board.

( ) Bend the two leads of the capacitor with the correct value at right angles to match their respective holes on the board. Insert the capacitor into the holes on the silk-screened side of the board. Be sure to align the positive polarity side with the "+" signs printed on the board.

( ) Holding the capacitor in place, turn the board over and bend the two leads slightly outward. Solder the leads to the foil pattern and clip off any excess lead lengths.

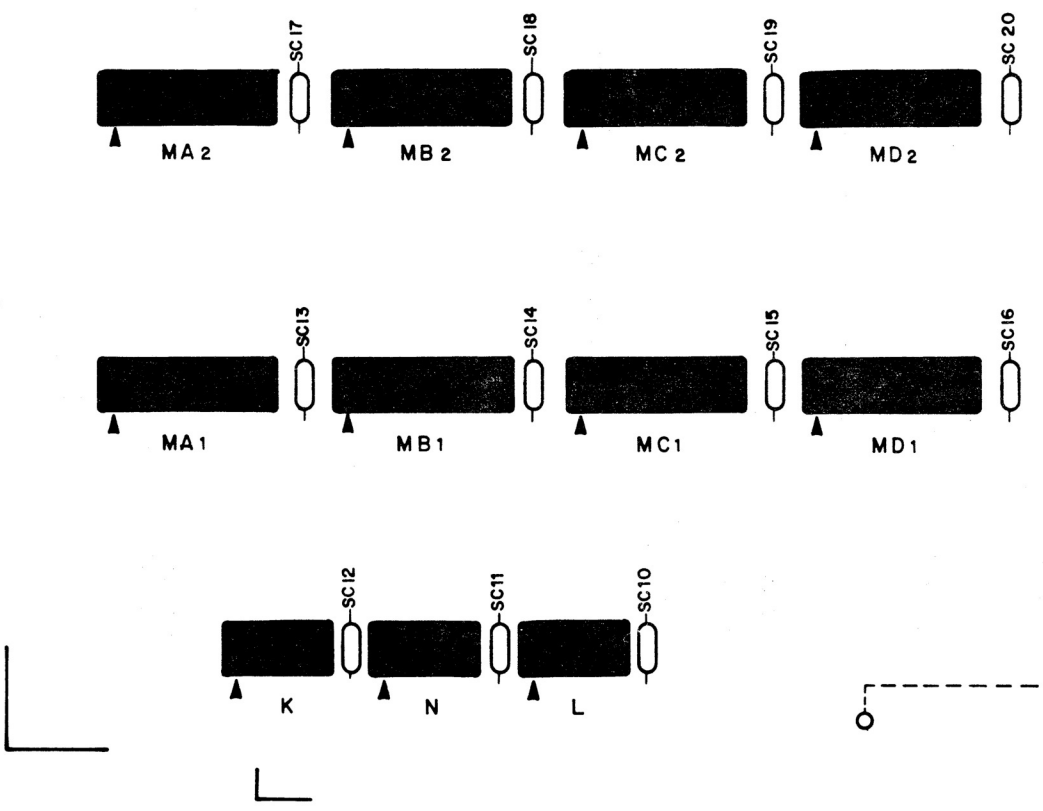
( ) Install the second electrolytic capacitor in the same manner.

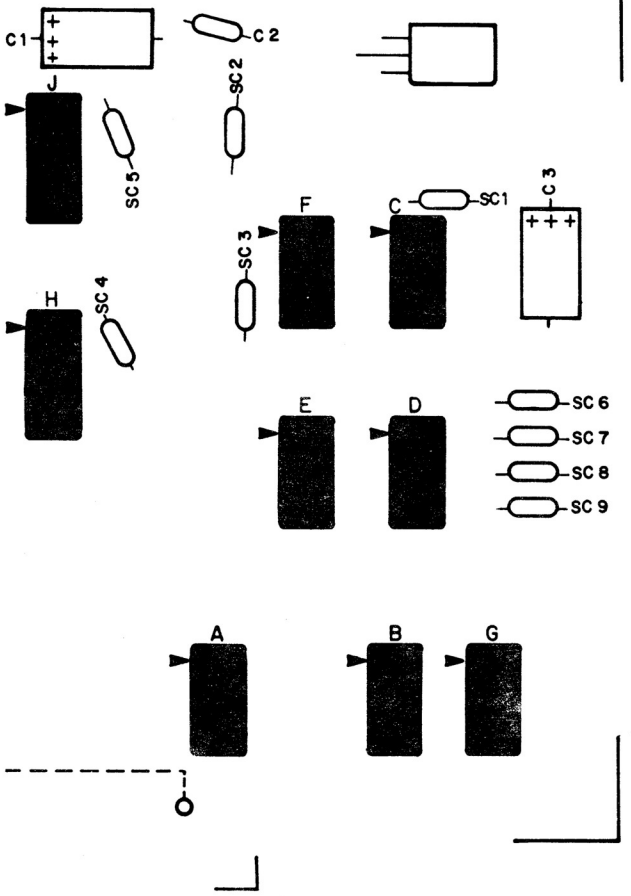
( ) C1 & C3 are 20uf to 35uf

( ) SC1 through SC20 are .1uf

( ) C2 is .1uf

8800 IK STATIC MEM BOARD
REV 0





Voltage Regulator Installation

There is one MC7805 5-volt regulator to be installed on the 8800 1K Static Memory Board.

( ) Set the MC7805 in place on the board and align the mounting holes. (see drawing)

( ) Use a pencil to mark the point on each of the three leads where they line up with their respective holes on the board.

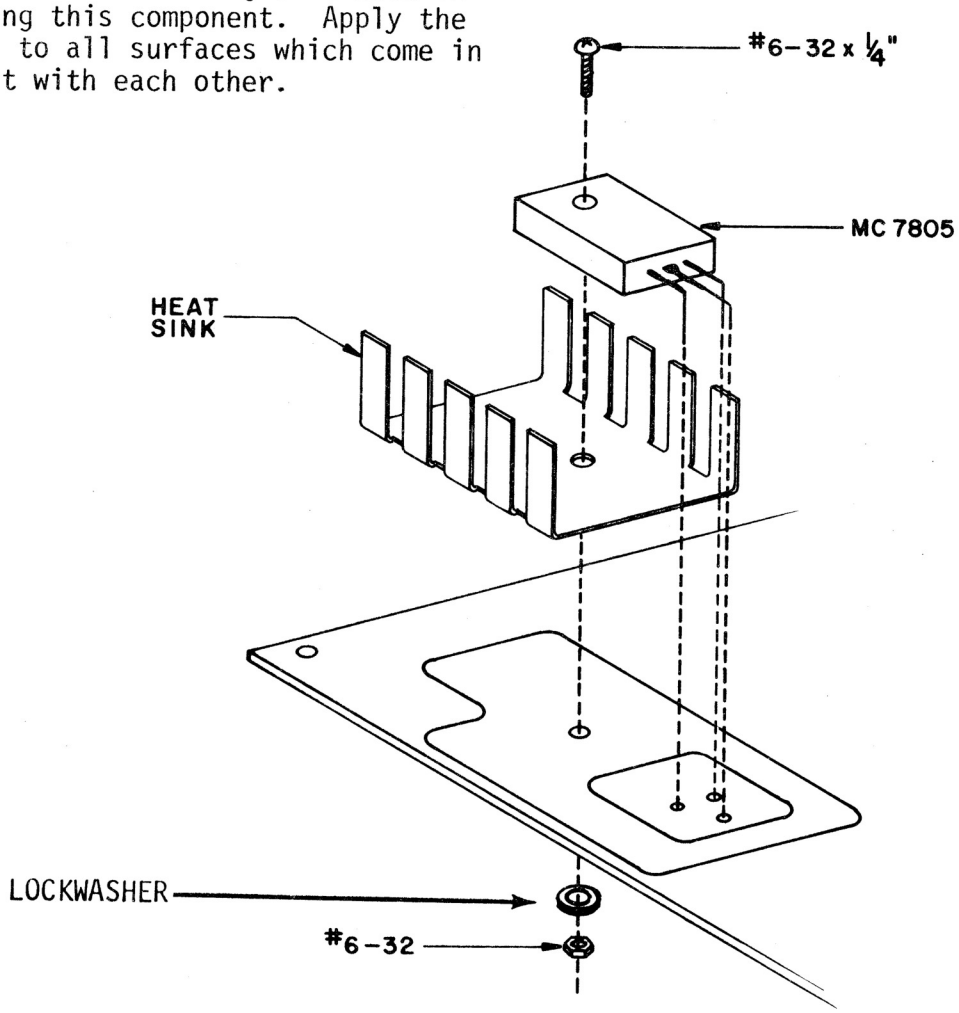
( ) Use needle-nose pliers to bend each of the three leads at a right angle on the points where you made the pencil marks.

( ) Referring to the drawing, set the regulator and heat sink in place on the silk-screened side of the board. Secure them to the board using a #6-32 nut. Hold the regulator in place as you tighten the nut to keep from twisting the leads.

( ) Turn the board over and solder the three leads to the foil pattern on the back side of the board. Be sure not to leave any solder bridges.

( ) Clip off any excess lead lengths.

NOTE: Use heat-sink grease when installing this component. Apply the grease to all surfaces which come in contact with each other.



Hardwire Jumper Connections

There are seven jumper connections to be made on the 8800 1K Static Memory Board.

( ) One jumper is indicated on the board by two pads marked "J1" connected with a broken line.

( ) Insert the two ends of the jumper wire from the silk-screened side of the board into the correct holes.

( ) Solder the wire ends to the foil pattern on the back side of the board; then clip off any excess lead lengths.

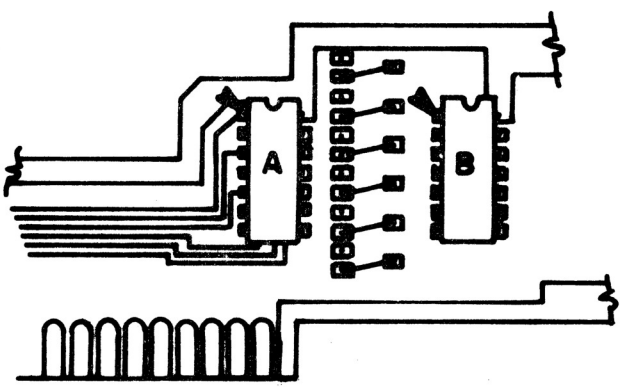
The remaining six jumpers can be made using uninsulated wire or the leftover leads clipped off of previously installed components.

( ) These six jumpers are located in the bottom right corner of the board, between IC's A and B.

( ) There is a row of 12 pads next to IC A, and a row of 6 pads directly opposite next to IC B. Each of the pads in the row of 6 is to be connected to one of the pads in the row of 12.

( ) Start with the bottom pad in the row of 6 pads and connect it in the same manner as above to the bottom pad in the row of 12.

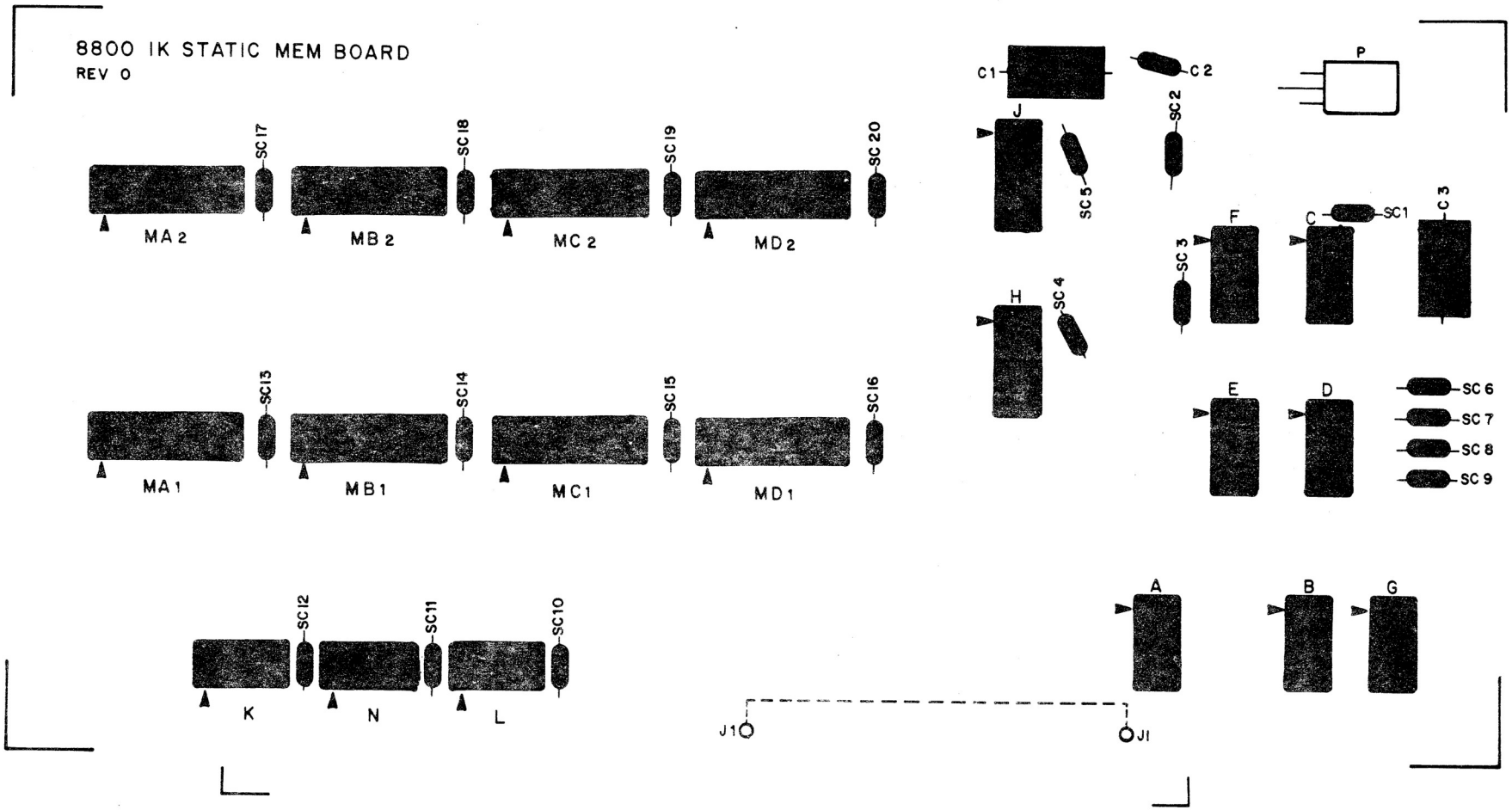
( ) In the same manner, connect each of the remaining pads in the row of 6 to every other one of the pads in the row of 12. Start at the bottom and work up. This should leave the top pad in the row of 12 empty.



NOTE: Further information on the function of these six jumpers will be recieved as necessary for future memory expansion.

( ) P is a uA7805

( ) Install J1

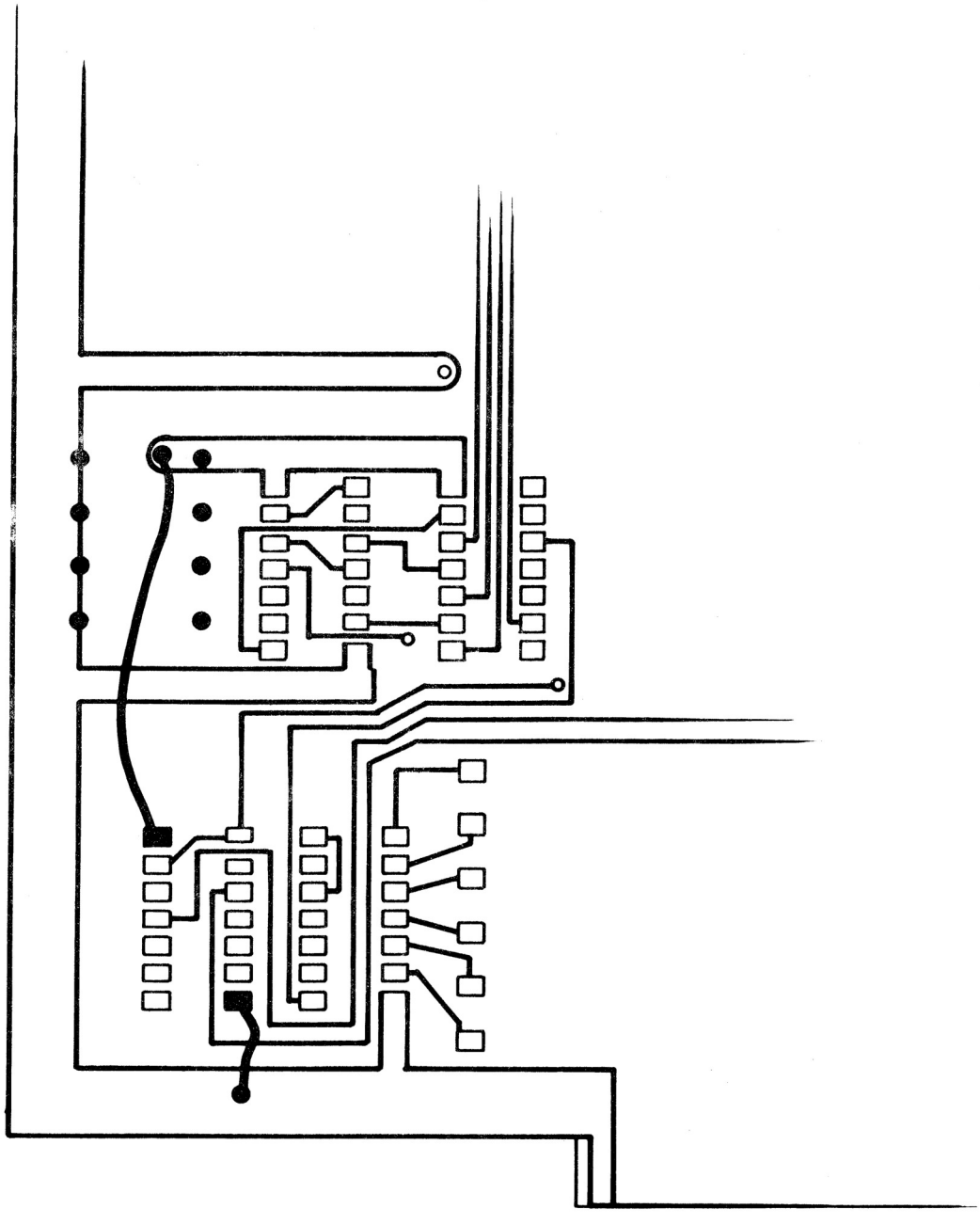


Power Jumper Connections

There are two hardwire connections to be made on the back (non silk-screened) side of the 8800 1K Static Memory Board.

( ) Referring to the drawing below, connect pins 7 and 14 to the appropiate lands on the board as shown.

NOTE: Be very careful when making these connections. The connections to the IC are made directly to the pins themselves. Check to make sure you do not leave any solder bridges or shorts to other pins or lands on the board.



8800 POWER SUPPLY BOARD ASSEMBLY

Resistor Installation

There are 4 resistors to be installed on the 8800 Power Supply Board.

NOTE: Resistors are color-coded according to their value. The resistors in your kit will have four or possibly five bands of color. The fourth band in both cases will be gold or silver, indicating the tolerance. In the following instructions we will be concerned only with the three bands of color to one side of the gold or silver band. Be sure to match these three bands of color with those called for in the insturctions as you install each resistor.

Using needle-nose pliers, bend the leads of the following resistors at right angles to match their respective holes on the PC board. (see component layout)

( ) R1 (470-ohm, 1/2W, yellow-violet brown)

( ) R2 (1K-ohm, 1/2W, brown-black-red)

NOTE: All resistors on the 8800 Power Supply Board are 1/2 Watt.

( ) Install resistor R1 (470-ohm, yellow-violet-brown) into the correct holes on the silk-screened side of the PC board.

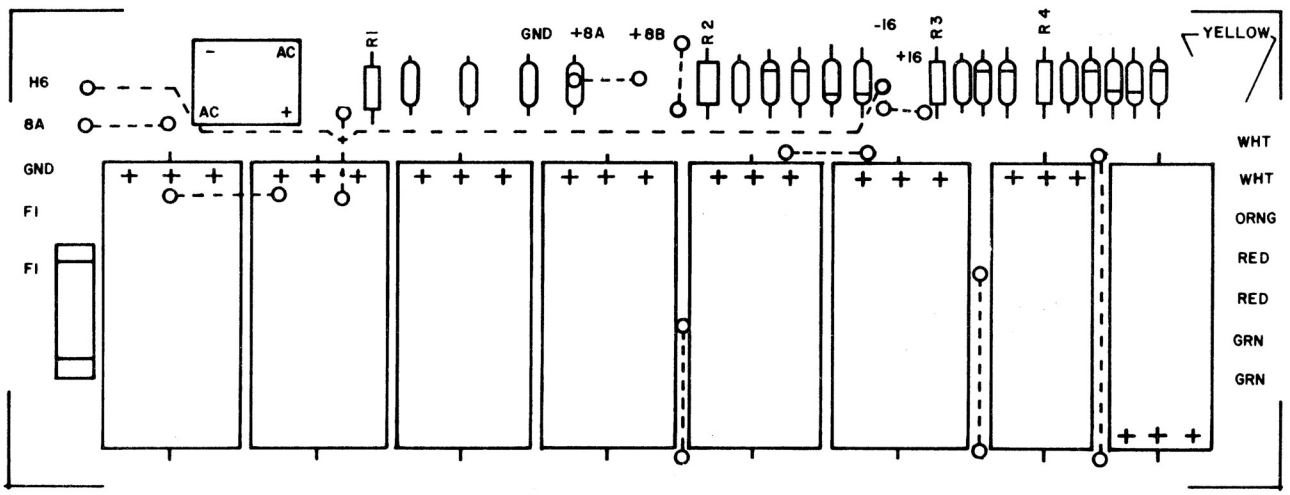
( ) Holding the resistor in place with one hand, turn the board over and bend the two leads slightly outward.

( ) Solder the leads to the foil pattern on the back side of the board; then clip off any excess lead lengths.

Referring to the component layout, install the remaining resistors in the same manner. Be sure you have the correct color-coding for each one as you install them.

( ) R3 (4.7K-ohm, 1/2W, yellow-violet red)

( ) R4 (4.7K-ohm, 1/2W, yellow-violet red)



Diode Installation

There are 10 diodes (1N4004's) to be installed on the 8800 Power Supply Board.

NOTE: Diodes are marked with a band on one end indicating the cathode end. The diode must be oriented so that the end with the band is towards the band printed on the board when being installed.

( ) Referring to the component layout, bend the leads of diode D1 (1N4004) at right angles to match the correct holes on the board.

( ) Insert the diode into the correct holes from the silk-screened side of the board. Turn the board over and bend the two leads slightly outward.

( ) Solder the two leads to the foil pattern on the back side of the board; then clip off any excess lead lengths.

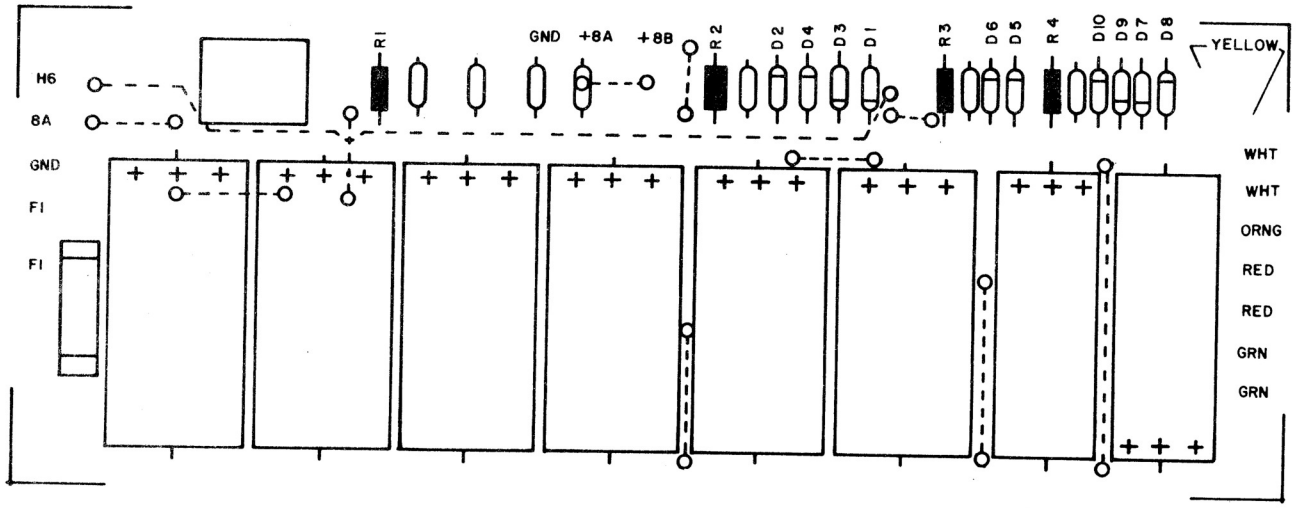
Install the remaining 9 diodes in the same manner. Be sure that you have the band on the diode aligned with the band printed on the board as you install each one. Failure to orient these diodes correctly may result in permanent damage to your unit.

D1 through D10 are all 1N4004 diodes.

( ) D1 ( ) D2 ( ) D3 ( ) D4

( ) D5 ( ) D6 ( ) D7 ( ) D8

( ) D9 ( ) D10



Ceramic Disk Capacitor Installation

There are 7 ceramic disk capacitors to be installed on the 8800 Power Supply Board.

Refer to the component layout and install the capacitors according to the following procedure.

( ) Choose the capacitor with the correct value as called for in the instructions. Straighten the two leads and bend them as necessary to fit their respective holes on the PC board.

( ) Insert the capacitor into the correct holes from the silk-screened side of the board. Push the capacitor down until the ceramic insulation almost touches the foil pattern.

( ) Holding the capacitor in place, turn the board over and bend the two leads slightly outward.

( ) Solder the two leads to the foil pattern on the back side of the board; then clip off any excess lead lengths.

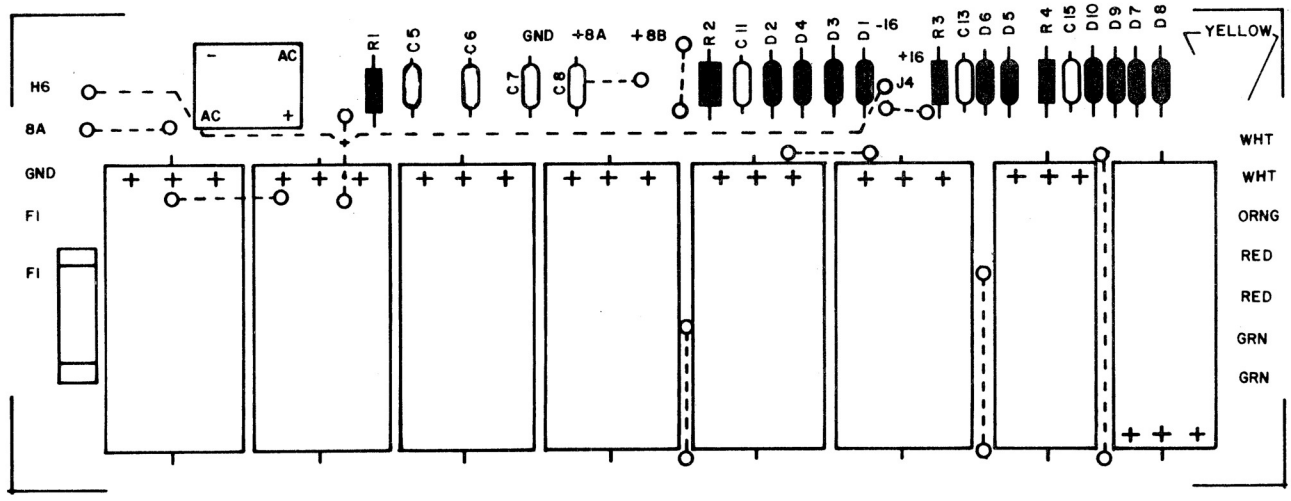
Install all of the ceramic disk capacitors in this manner. Be sure you have the correct value capacitor as you install each one.

All ceramic disk capacitors are .luf.

( ) C5 ( ) C6 ( ) C7 ( ) C8

( ) C11 ( ) C13 ( ) C15

NOTE: Capacitors C13 and C15 must be rated at 50V. The voltage rating on the other capacitors may vary with the stock supply.



Rectifier Installation

There is one 10 amp bridge rectifier (VJ048) to be installed on the 8800 Power Supply Board.

WARNING: It is very important that this component be properly oriented before it is soldered into place. If it is not in the correct orientation it may cause major damage to the rest of your unit.

There is a "+" and a "-" sign on opposite sides of the VJ048 rectifier. The four leads of this component should be aligned so that the "+" and "-" signs printed on the board correspond with the signs marked on the rectifier itself.

( ) Referring to the drawing on the opposite page, physically mount the rectifier to the foil pattern side of the board as shown. It is very important that the spacing be precisely as indicated in the drawing.

( ) Check to make sure that the "+" and "-" signs on the board and the VJ048 correspond.

( ) Very carefully solder the four leads to the foil pattern. You will be soldering between the board and the body of the rectifier, so take extra care not to leave any solder bridges.

( ) Clip the excess lead lengths from the top of the board; then remove the nut and other hardware so that only the solder connections are holding the rectifier in place.

Hardwire Jumper Connections

There are 11 jumper connections to be made on the 8800 Power Supply Board.

The jumper connections are indicated on the board by two pads with the same designation and connected by a broken line. (see component layout)

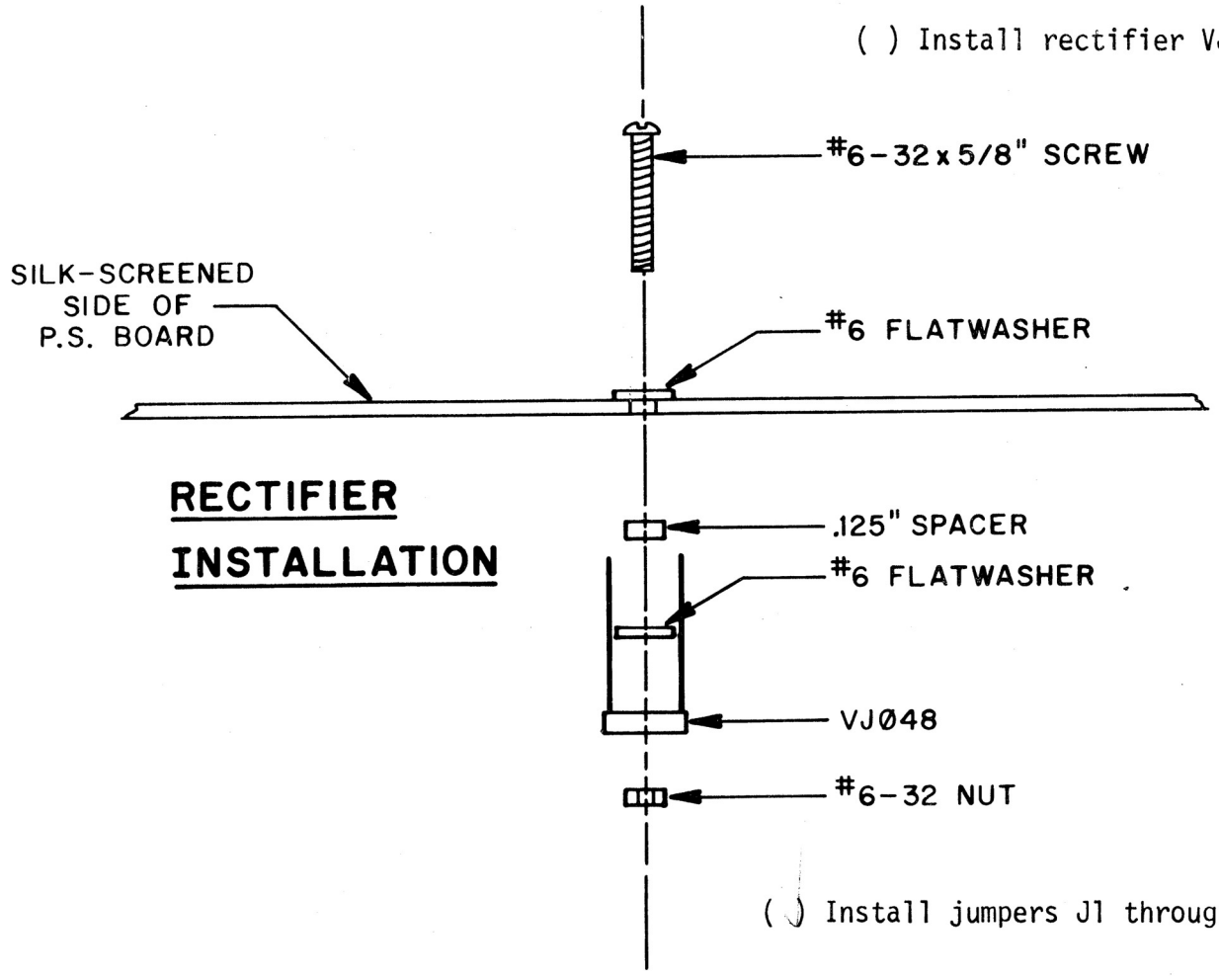
Care must be taken when installing these jumpers to be sure that you do not short them to any other components on the top of the board. All of the jumpers except the one marked "J4" can be made with uninsulated bus wire if desired.

( ) Connect J1 to J1, J2 to J2, etc. by inserting the jumper wires from the silk-screened side of the board and soldering them to the foil pattern on the back side.

Be sure to install all 11 jumpers and be careful not to create any shorts between components.

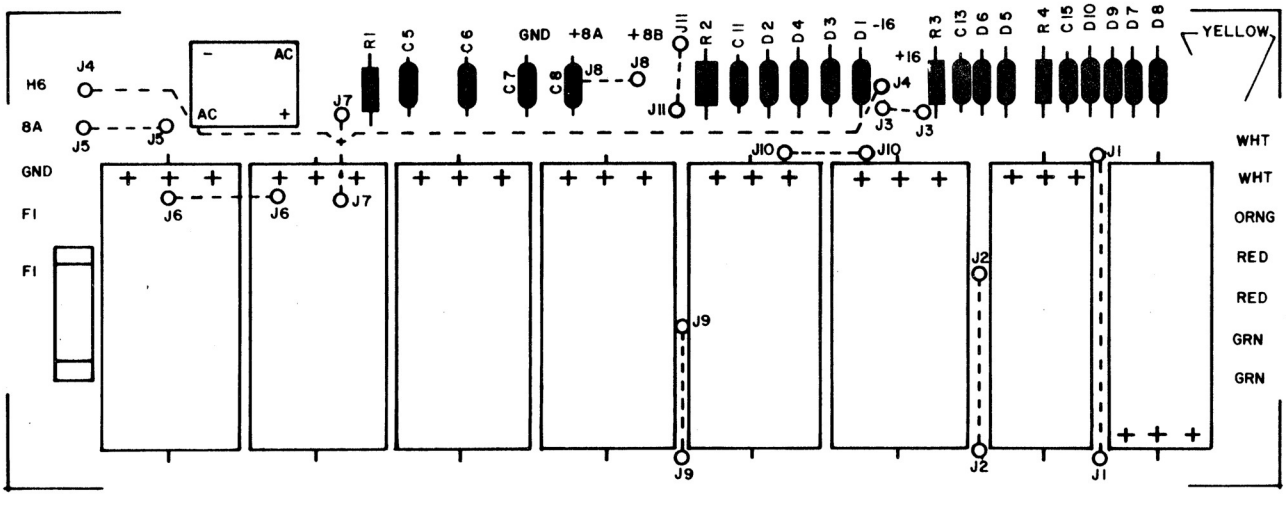
( ) Clip off any excess lead lengths.

( ) Install rectifier VJ048



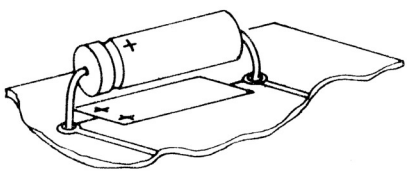
RECTIFIER INSTALLATION

( ) Install jumpers J1 through J11

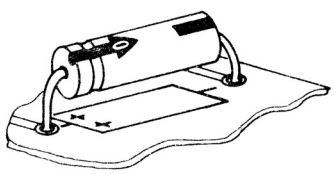


Electrolytic Capacitor Installation

There are eight electrolytic capacitors to be installed on the 8800 Power Supply Board. These capacitors have polarity requirements which must be noted before installation. Those contained in your kit may have one or possibly two of three types of polarity markings. To determine the correct orientation, look for the following: (see drawing below)



ELECTROLYTIC CAPACITOR



One type will have plus (+) signs on the positive end; another will have a band or a groove around the positive side in addition to the plus signs. The third type will have an arrow on it; in the tip of the arrow there is a negative (-) sign and the capacitor must be oriented so the arrow points to the negative polarity side.

Referring to the component layout, install the electrolytic capacitors on the board.

( ) Bend the two leads of the capacitor with the correct value at right angles to match their respective holes on the board. Insert the capacitor into the holes on the silk-screened side of the board. Be sure to align the positive polarity side with the "+" signs printed on the board.

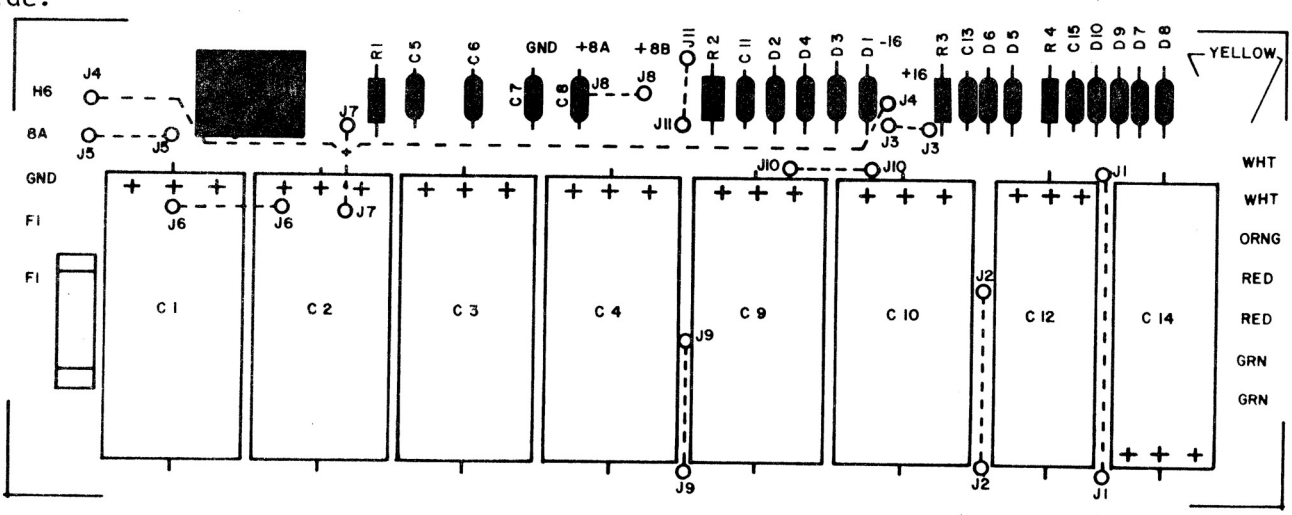
( ) Holding the capacitor in place, turn the board over and bend the two leads slightly outward. Solder the leads to the foil pattern and clip off any excess lead lengths.

( ) Install all of the capacitors in the same manner.

( ) C1, C2, C3, C4, C9, and C10 are all 3300uf capacitors.

( ) C12 is any value from 1000 to 2200uf.

( ) C14 is 500uf.



Fuse and Fuse Clip Installation

There are two fuse clips and a fuse to be installed on the 8800 Power Supply Board.

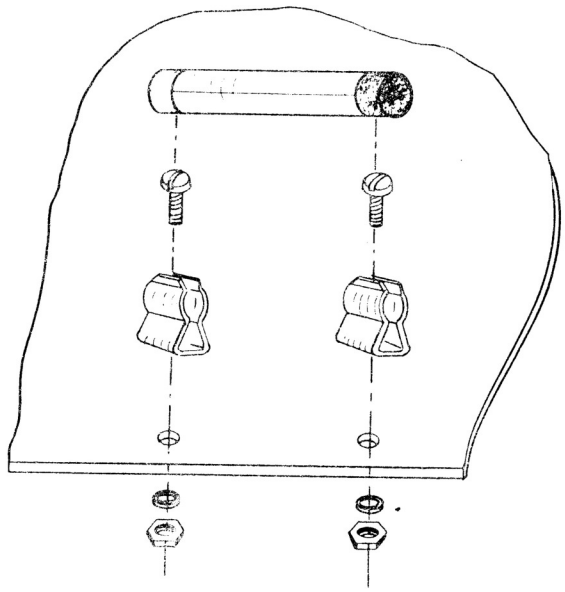
( ) Spread one of the fuse clips apart slightly and insert a #4-40 X 1/4 inch screw. (see drawing)

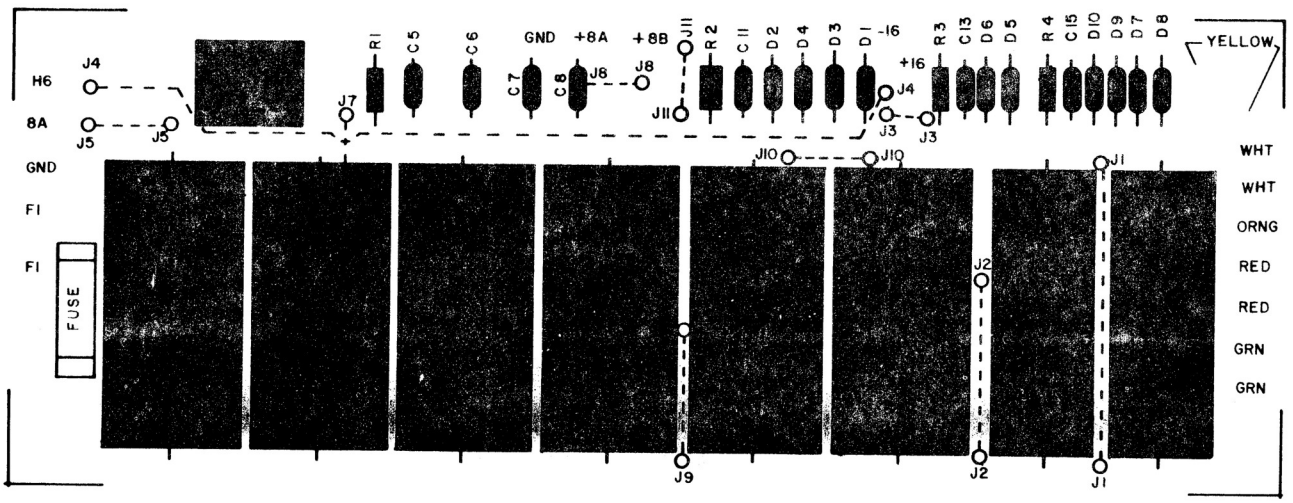
( ) Align the clip and screw over the correct hole on the silk-screened side of the board and insert the screw into the hole.

( ) Holding the clip and screw in place with a screwdriver, place a #4-40 lockwasher and nut onto the screw on the foil side of the board and tighten them securely.

( ) Install the second clip in the same manner; then push the clips back together so they will hold the fuse.

( ) Carefully insert the fuse into the clips. Be sure that the clips hold the fuse securely in place.





TRANSFORMER MOUNTING

There are three power supply transformers to be mounted on the 8800 back panel.

Transformer T1 is mounted using four #8-32 X 3/8 inch screws with a flat-washer, lockwasher and nut on each of them. (see drawing)

( ) Referring to the drawing, set T1 in place and install the four mounting screws with washers and nuts. DO NOT TIGHTEN THE NUTS DOWN AT THIS TIME.

( ) You will observe that the mounting holes on T1 are oval rather than round.

( ) Set the cross member in place directly beneath T1 and allow the transformer to slide down until it rests on the cross member. Now tighten the two top mounting screws on T1 as securely as possible.

( ) Remove the cross member and tighten the two bottom mounting screws on T1 as securely as possible.

Transformer T2 is mounted using two #6-32 X 3/8 inch screws with a lock-washer and nut on each of them. (see drawing)

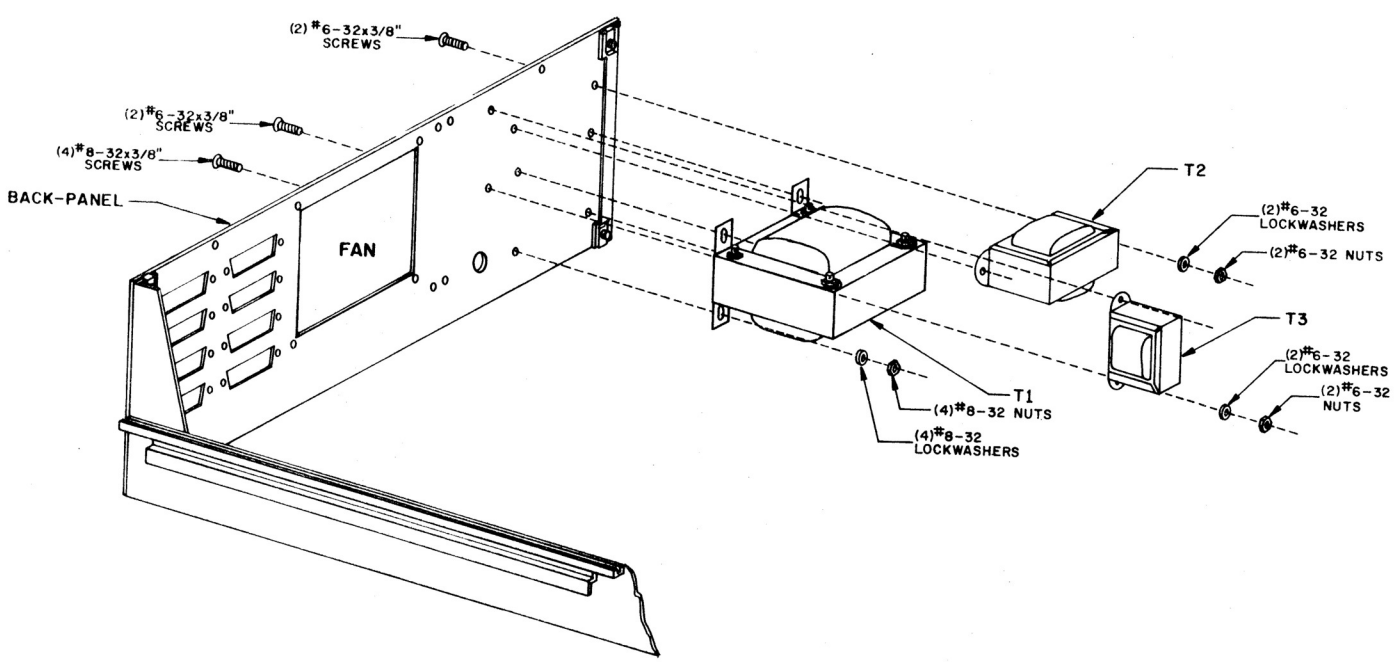
( ) Referring to the drawing, set T2 in place and install the two mounting screws with lockwashers and nuts.

( ) Tighten the screws down as securely as possible.

Transformer T3 is mounted using two #6-32 X 3/8 inch screws with a lock-washer and nut on each of them. (see drawing)

( ) Referring to the drawing, set T3 in place and install the two mounting screws with lockwashers and nuts.

( ) Tighten the two screws down as securely as possible.



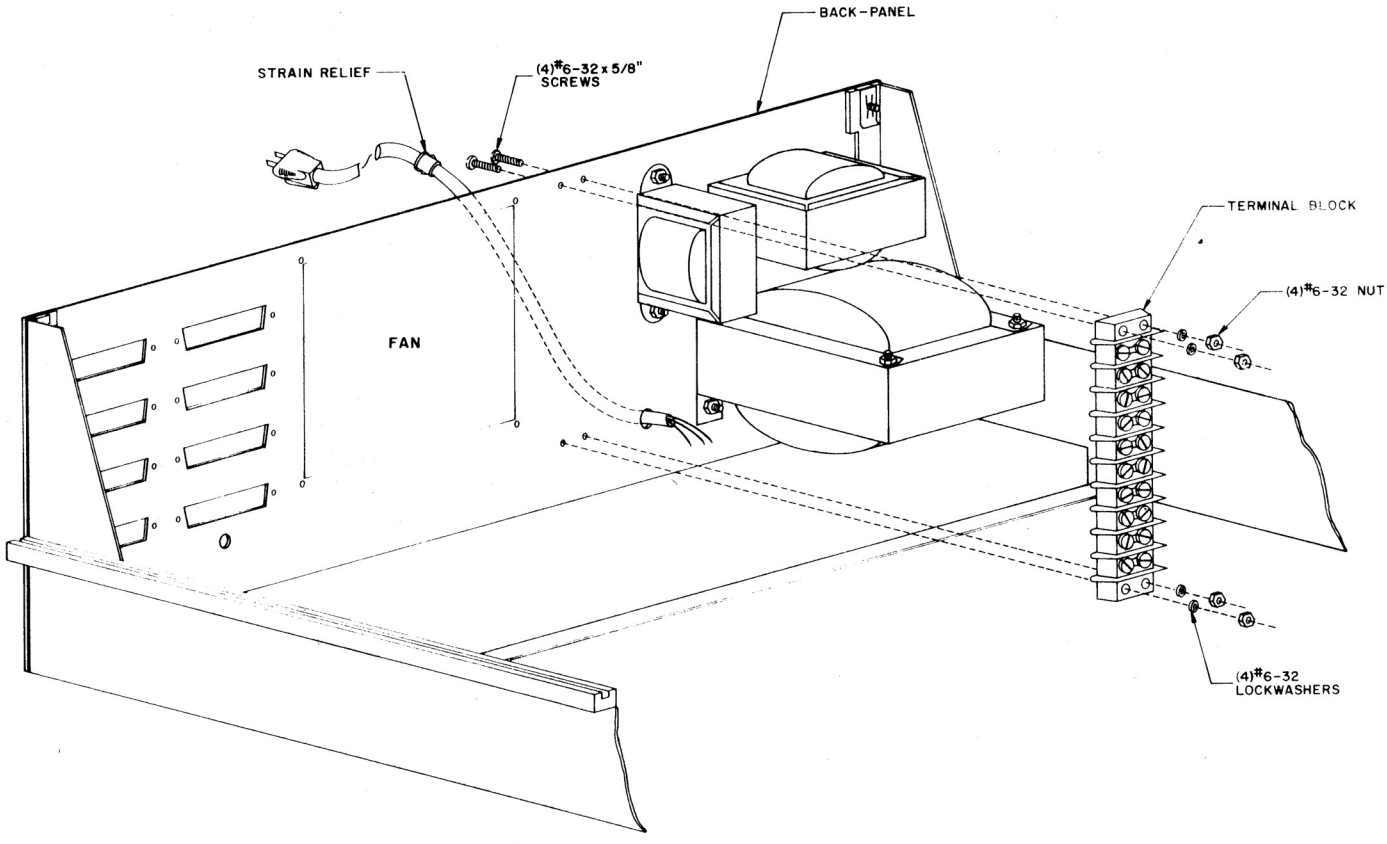
TERMINAL BLOCK MOUNTING

There is one terminal block with a double row of ten terminals to be installed on the 8800 back panel.

( ) Strip approximately 8 inches of casing from the power supply cord by cutting a circle 8 inches from the end of the case and pulling the black insulation off. Be careful not to cut into any of the three wires inside the cord.

( ) Referring to the drawing below, mount the terminal block as shown using four #6-32 X 5/8 inch screws with lockwashers and nuts. Tighten them securely into place.

( ) Refer to the drawing again and set the AC power cord in place at this time.

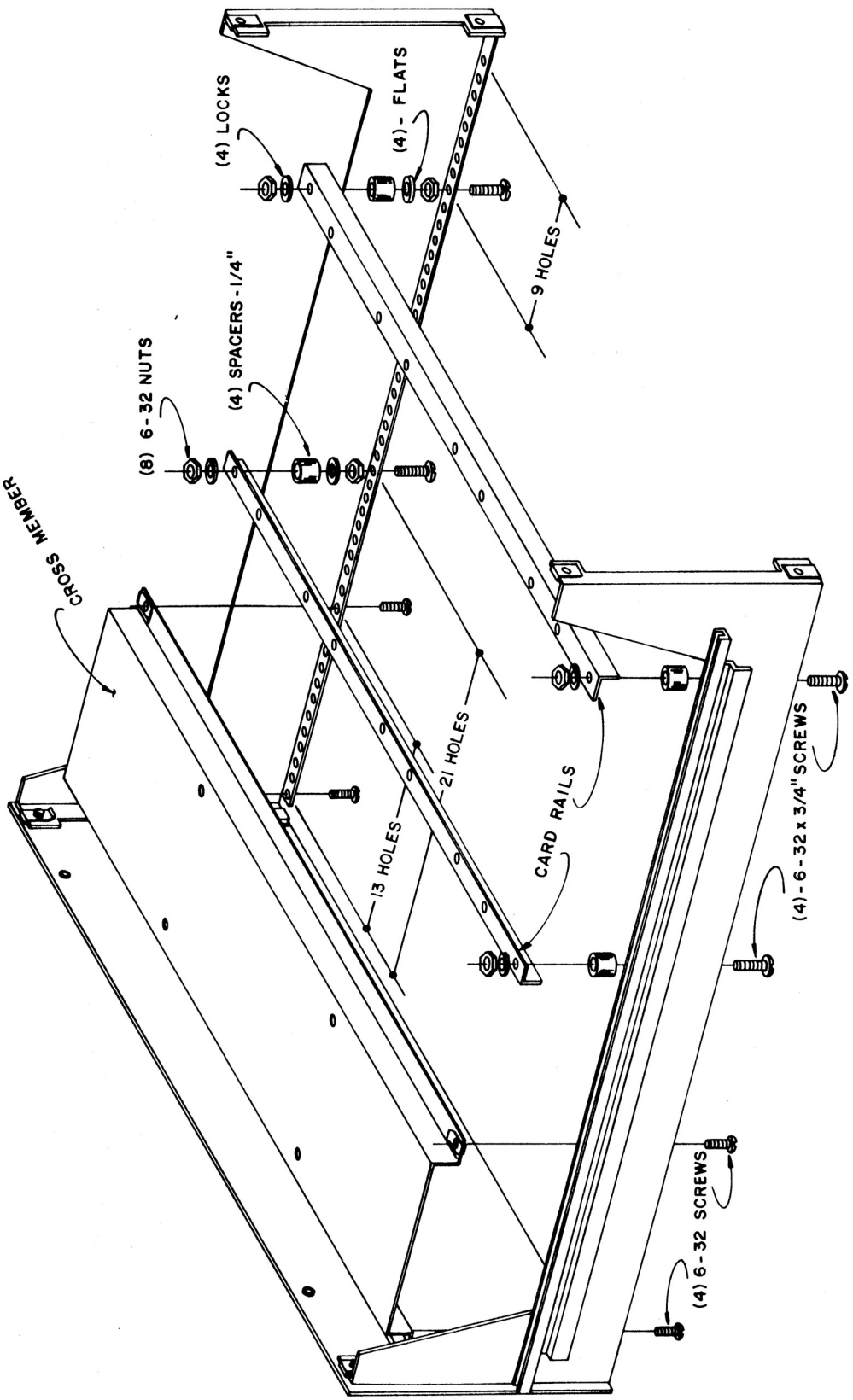


CHASSIS ASSEMBLY

There is one cross member and two card rails to be installed on the 8800 chassis.

(✓) Refer to the drawing below and set the cross member in place beneath the transformers. Tighten it down securely.

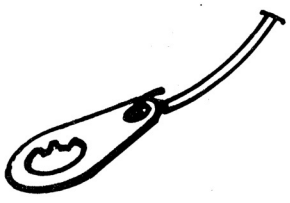
( ) Referring to the drawing, set the two card rails in place and tighten them down securely. Be sure that you connect them to the holes as indicated in the drawing.


(4) LOCKS
(4) - FLATS
9 HOLES
(4) SPACERS - 1/4"
(8) 6 - 32 NUTS
CROSS MEMBER
21 HOLES
13 HOLES
CARD RAILS
(4) - 6 - 32 x 3/4" SCREWS
(4) 6 - 32 SCREWS

TERMINAL LUG INSTALLATION

There are 24 terminal lugs to be installed onto wires at this time for later connection to the terminal block.

Make all of the connections between the terminal lugs and the wires as shown in the drawing below. Try to make the connection so that the insulated portion of the wire runs right up to the lug itself; this will help prevent any accidental shorting.



TERMINAL LUG

( ) Connect terminal lugs to the two black primary wires on each of the three transformers.

( ) Connect terminal lugs to each of the three wires in the AC power cord.

( ) Connect terminal lugs to the two wires from the Display/Control Board that you labeled "AC SW".

( ) Connect terminal lugs to the two wires from the Display/Control Board that you labeled "GND" and "+8vB".

NOTE: There is a roll of #20 insulated wire included in your kit for making the following connections. Add an inch to each of the lengths called for in the instructions and cut the wires from this roll. Strip 1/2 inch of insulation from the ends of the wires and tin them by applying a thin coat of solder.

( ) Connect a terminal lug to each of five 8-inch lengths of wire. Connect only one lug on one of the ends of each wire.

( ) In the same manner, connect a terminal lug to one end of two 12-inch lengths of wire.

( ) In the same manner, connect a terminal lug to one end of four 24-inch lengths of wire.

POWER SUPPLY BOARD WIRE CONNECTIONS

There are 16 wire connections to be made to the 8800 Power Supply Board. Nine of these are from the transformers and the other seven will be connected to the terminal block. (see wiring diagram)

Transformer Connections

( ) Connect one of the green secondary wires from transformer T1 to one of the pads on the power supply board labeled "GRN". Make the connection by inserting the wire from the silk-screened side of the board and soldering it to the foil pattern on the back side. Clip off any excess lead length.

Make the following connections in the same manner.

( ) Connect the second green wire from T1 to the other pad labeled "GRN".

( ) Connect the two red wires from T2 to the two pads on the board labeled "RED".

( ) Connect the orange wire from T2 to the pad labeled "ORANG".

( ) Connect the two white wires from T2 to the two pads labeled "WHT".

( ) Connect the two yellow wires from T3 to the two pads labeled "YELLOW".

Terminal Block Wire Connections

( ) Using the same type connection as with the transformer wires, connect the bare end of one of the 8-inch wires with a terminal lug on it to the pad on the power supply board labeled "+16".

In the same manner, connect 8-inch wires with terminal lugs attached to the following pads on the board:

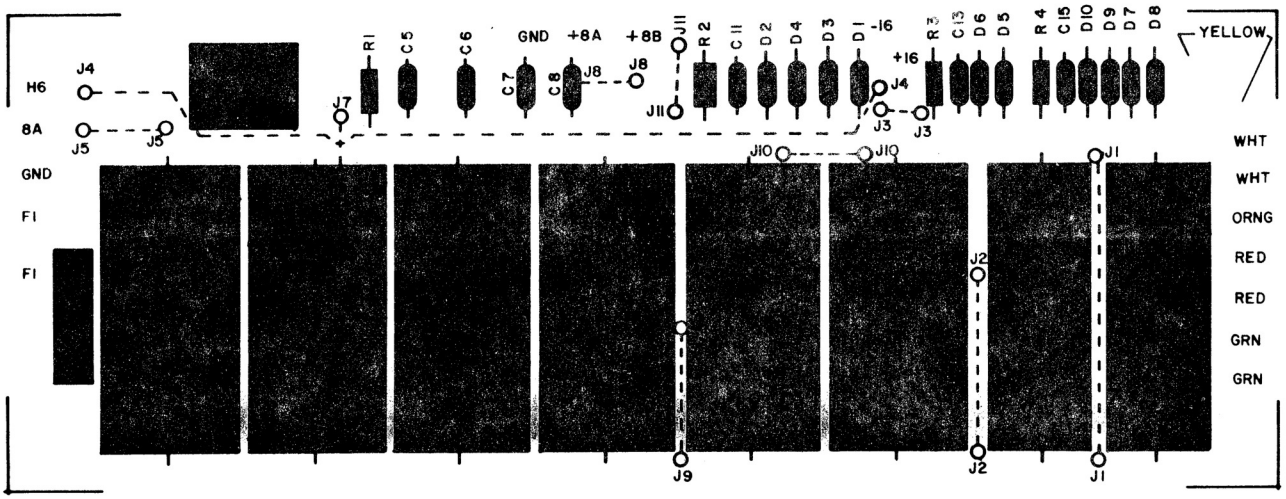
( ) -16 ( ) +8B ( ) +8A

( ) GND pad near C7

In the same manner, connect 12-inch wires with terminal lugs attached to the following pads on the board:

( ) F1 (top) ( ) F1 (bottom)

NOTE: The three pads "H6", "8A" and "GND" on the left are for future expansion.



POWER SUPPLY BOARD MOUNTING

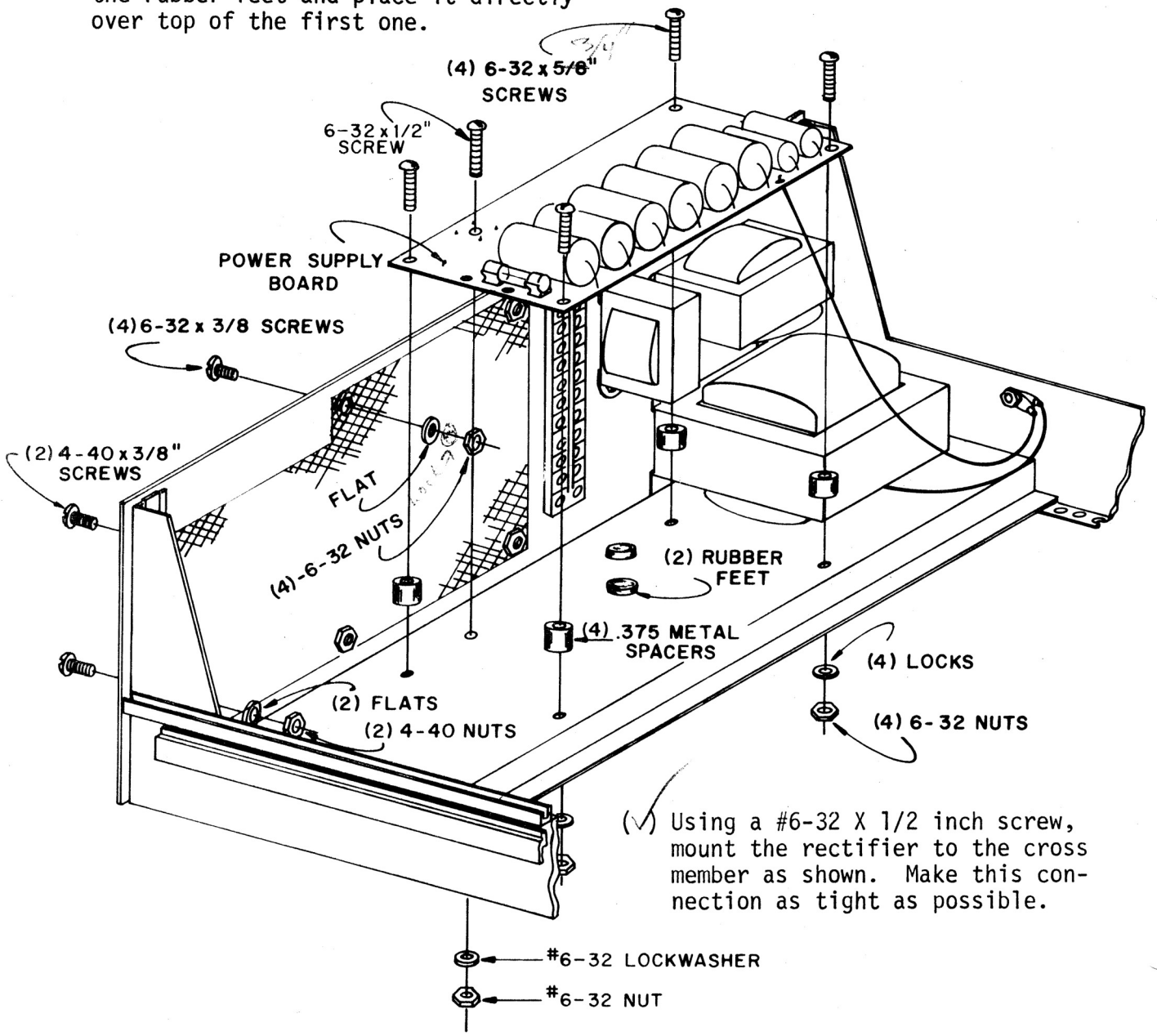
The 8800 Power Supply Board is mounted directly to the chassis cross member.

( ) Referring to the drawing, remove the backing from one of the small flat rubber feet included in your kit and place it in the center of the four mounting holes for the power supply board on the cross member.

( ) Remove the backing from another of the rubber feet and place it directly over top of the first one.

(✓) Referring to the drawing, mount the screen on the inside of the back panel.

( ) Refer to the drawing and mount the power supply board to the cross member as shown. Be careful not to catch any of the wires underneath the board as you mount it. Tighten it securely into place.



(✓) Using a #6-32 X 1/2 inch screw, mount the rectifier to the cross member as shown. Make this connection as tight as possible.

Chassis Ground Connection

There is one wire connection to be made between the Power Supply Board and the 8800 chassis.

( ) Referring to the procedure on page 58, connect a terminal lug to an insulated wire approximately 14 inches long.

(√) In the same manner as the connections on page 59, connect the wire to the Power Supply board. Connect the end opposite the terminal lug to the hole on the board located between the bottom hole of jumper "J1" and the positive end of C14.

( ) The terminal lug end of the wire should be routed around the transformers and mounted to the chassis with the same connection as the power cord ground wire as described on page 61.

POWER SUPPLY CONNECTIONS

There are 15 connections to be made to the terminal block on the 8800 back panel.

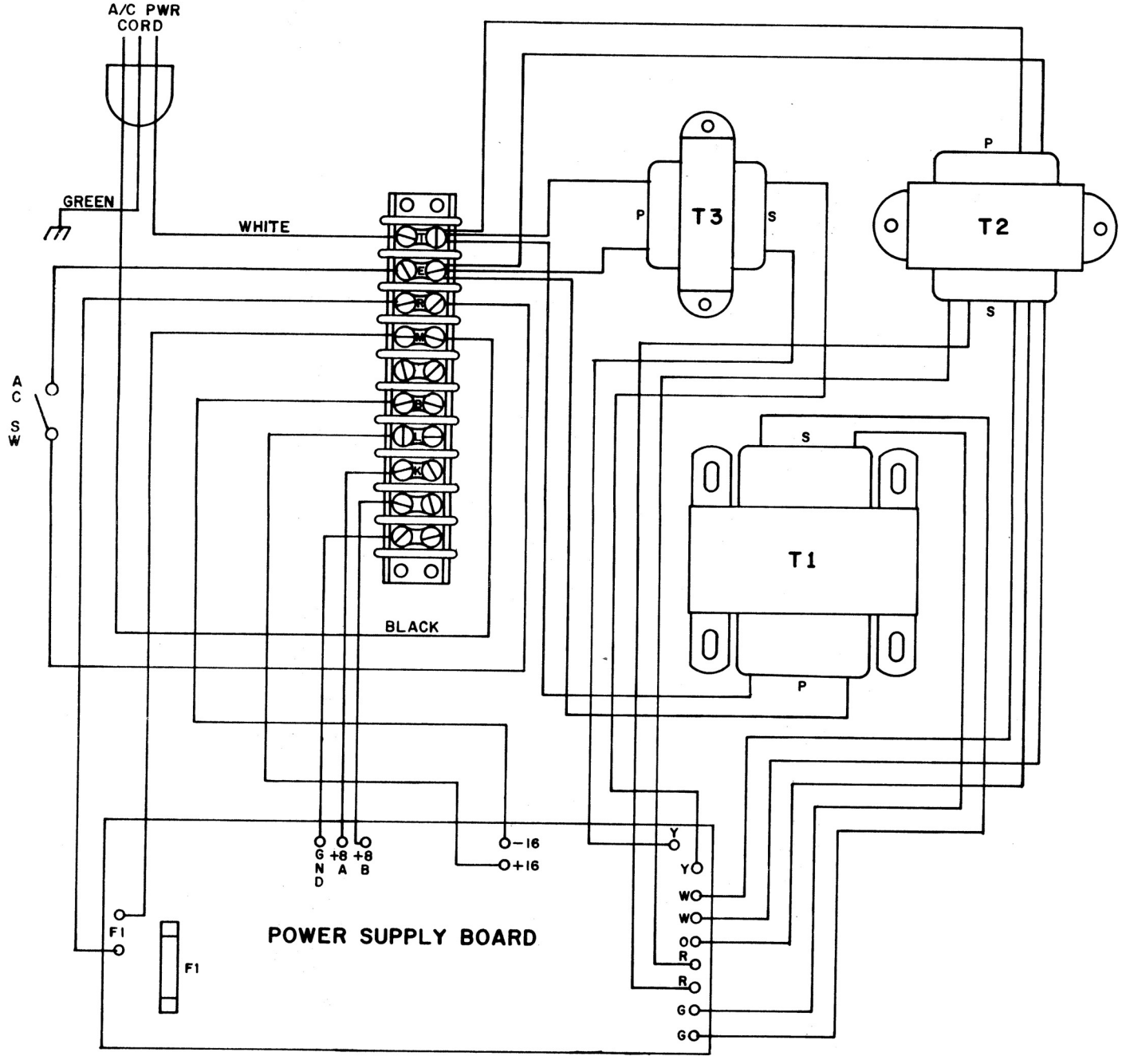
( ) Refer to the "POWER SUPPLY WIRING DIAGRAM" on the following page and connect all of the wires shown to the terminal block, except "AC SW".

NOTE: These are all wires to which you have attached terminal lugs earlier. Be sure to connect the lugs to the exact locations indicated in the wiring diagram. Use a screwdriver to make the connections, and be sure they are as tight as possible.

( ) The green ground wire on the AC Power Cord should be routed around behind the transformers and connected to the side of the chassis itself. The wire should reach to approximately the 14th hole from the back and should be attached to the top row of holes.

NOTE: The chassis is anodized, so use a pieces of sandpaper or steel wool to scratch the finish around the hole for the wire. Use a #6-32 X 1/4 inch screw and a #6-32 nut to mount the lug. The screw head should be on the outside of the chassis.

POWER SUPPLY WIRING DIAGRAM



EXPANDER BOARD 8800 M/BD ASSEMBLY

There are up to four edge connectors to be mounted on each 8800 M/BD expander board. These connectors are all to be mounted in the same manner.

Observe that the edge connectors each have a double row of pins; one side is numbered 1 through 50 and the other side is lettered A through AF. These markings are indicated on both the top and the bottom of the connectors.

Observe that the expander board has a foil pattern only on one side. The connectors will be mounted on the blank side of the board.

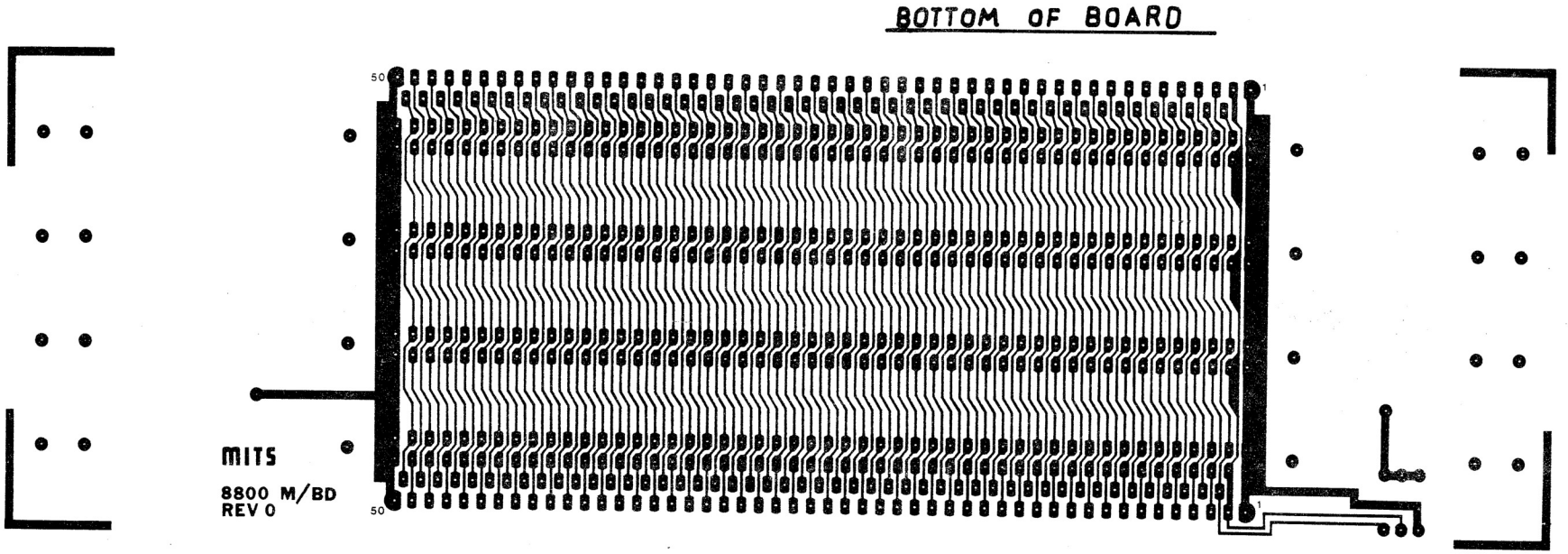
( ) Orient the expander board in front of you with the foil pattern on the bottom. The board designation markings (MITS 8800 M/BD, etc.) should be underneath, in the right corner towards you. Looking at the blank side of the board, this will place pin 1 on the left and pin 50 on the right.

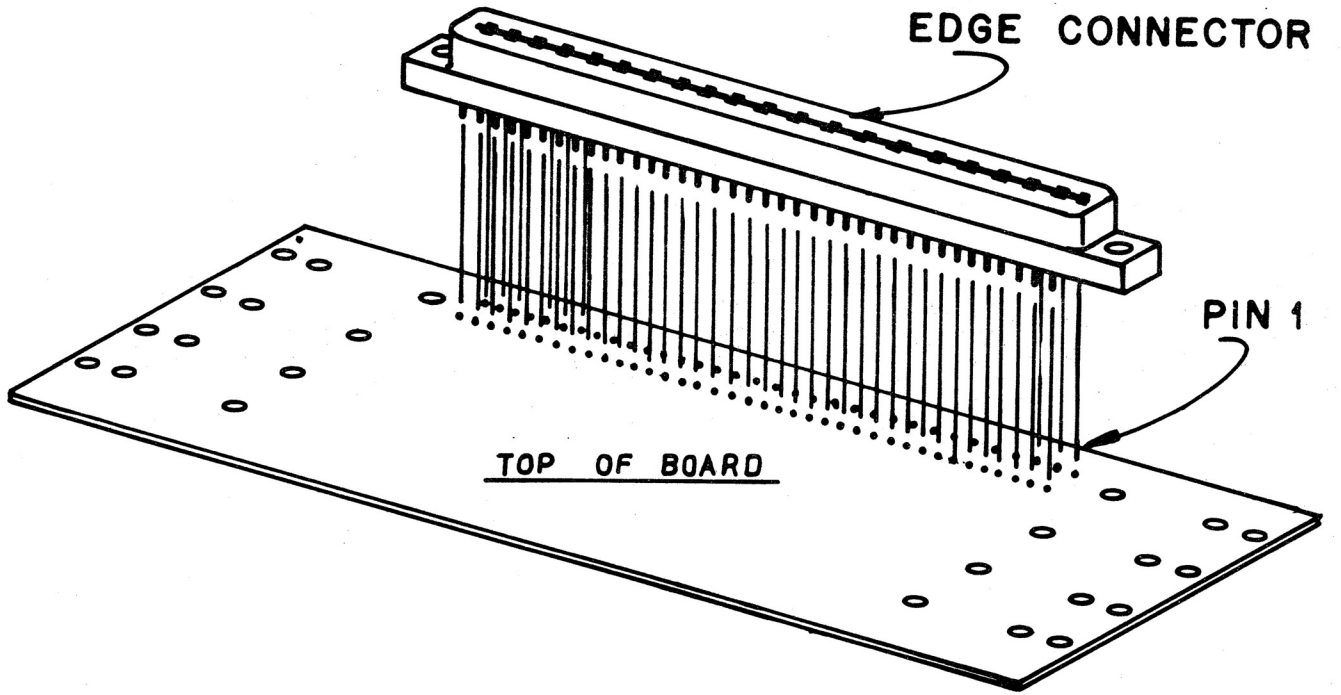
( ) Orient one of the edge connectors so that the numbered pins are towards you and the lettered pins towards the back, with the pins themselves pointing downward. This should place pins 1 and 50 with the same orientation as the 1 and 50 on the bottom (foil side) of the board.

( ) The edge of the board towards you has four rows of holes close together. The first two rows are staggered from each other and will be used later for wiring. The second two rows are in line and match the pins on the connector. Insert the connector into the 2nd two rows of holes keeping the same orientation as above. It may be necessary to use the tip of a scribe or a screwdriver to help guide the pins into the holes.

( ) Be sure that the connector is tight against the board and that all 100 pins are in their holes; then turn the board over and solder the pins to the foil pattern. Be careful not to leave any solder bridges between the pins or the lands.

( ) Mount all of the edge connectors to the expander board in the same manner.


BOTTOM OF BOARD
50
1
MITS
8800 M/BD
REV 0
50
1


EDGE CONNECTOR
PIN 1
TOP OF BOARD

EXPANDER BOARD WIRING

Place the expander board in front of you with the same orientation as at the beginning of the previous step. Observe the two staggered rows of holes towards the front edge of the board. These holes correspond with the pins on the connector. The row of holes closest to the edge of the board corresponds to pins 1 through 50 consecutively from left to right. The second row corresponds to pins 52 through 99 consecutively from left to right. (52 = B, 99 = AE) (see drawing and bus chart)

NOTE: Pins 51 and 100 are electrically common with pins 1 and 50 and thus are not used for wiring the bus.

( ) Orient the Display/Control Board in front of you with the sub-panel and switches facing down and the row of wire connections along the longer edge of the board towards you.

( ) Orient the expander board so that it is approximately 4 inches away from the back edge of the Display/Control Board. It should be setting so that the two rows of holes described above are to the right and the shorter edge of the board towards you. (see drawing)

( ) Referring to the drawing, remove the nut and lockwasher from the front right corner of the Display/Control Board. Place all of the wires, except "GND", "(+8V)B", and "AC SW", through the cable clamp and remount the clamp to the corner with the same nut and lockwasher.*

( ) Connect the wires from the Display/Control Board labeled with numbers to the expander board according to the following procedure.

( ) One at a time, take one of the wires and stretch it out to the hole on the expander board corresponding to the same number as the label on the wire.

( ) Cut the wire 1/2 inch longer that the length necessary to reach its hole; then strip 3/8 inch of insulation from the cut end. Tin the exposed portion of the wire by applying a thin coat of solder.

( ) Insert the end of the wire into its hole from the blank side of the board, being careful not to push any of the insulated portion of the wire into the hole.

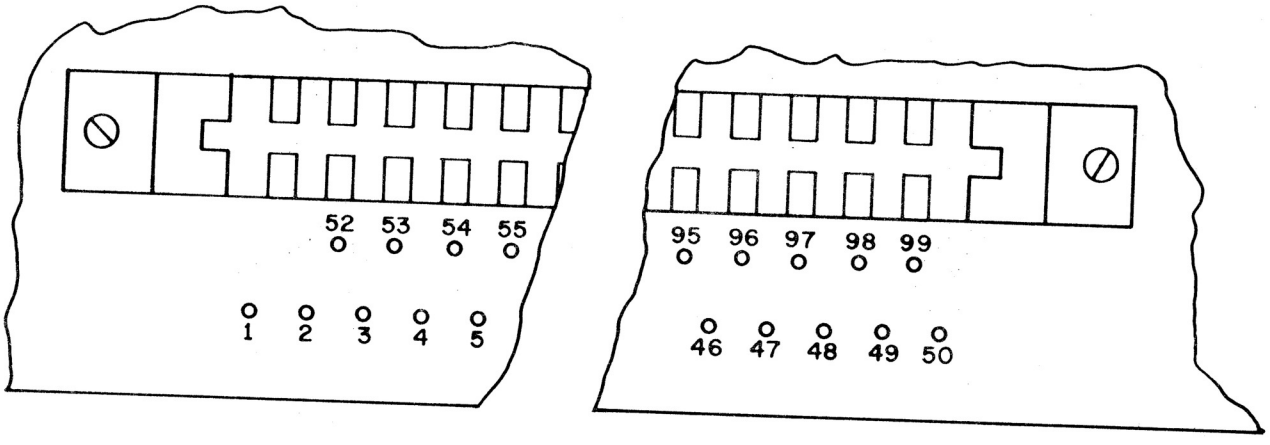
( ) Turn the board over and solder the wire to the foil pattern on the bottom side. Clip off any excess lead length.

( ) Follow this same procedure for each of the wires.

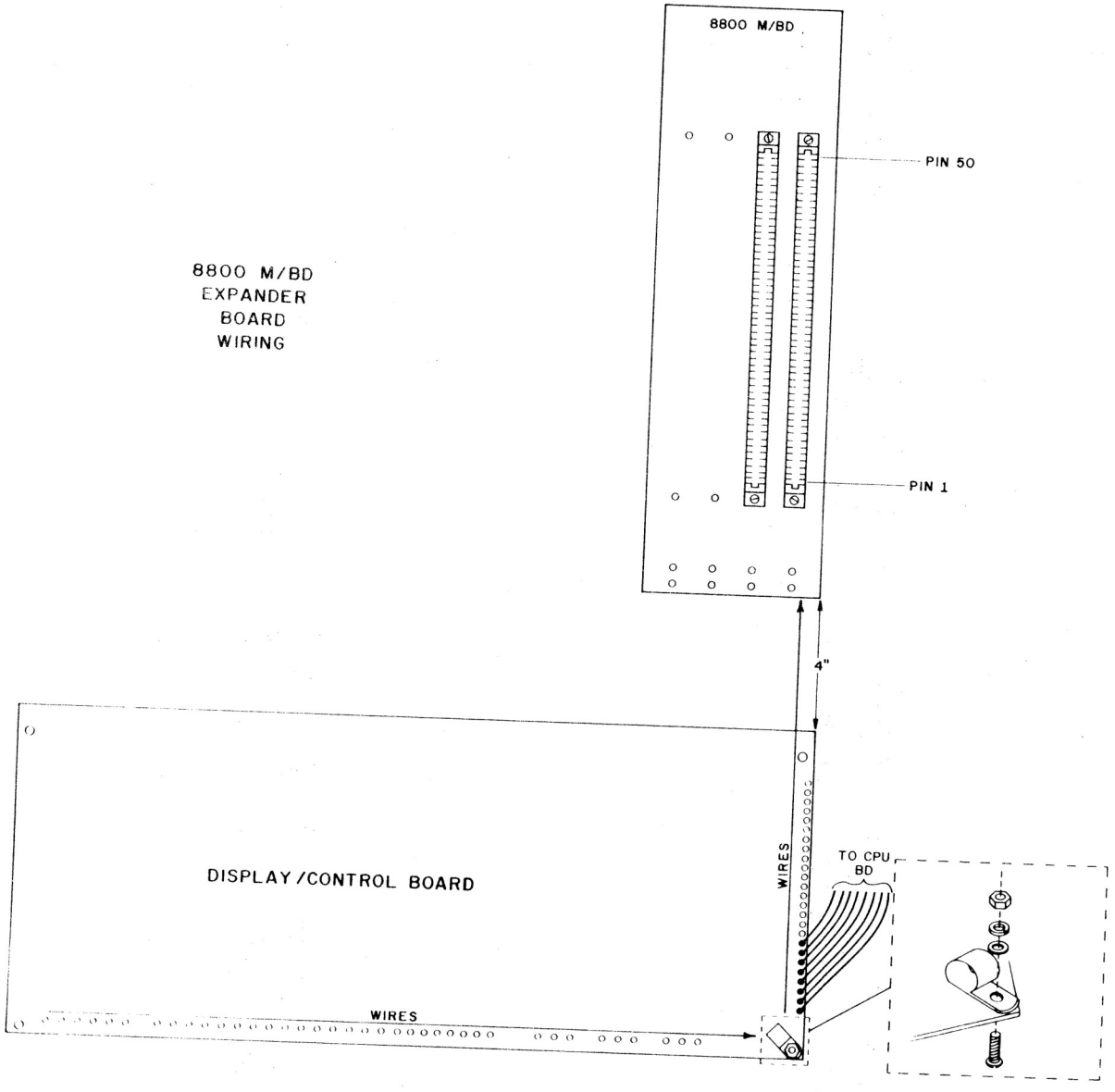
MAKE SURE THAT THE NUMBER ON THE WIRE LABEL CORRESPONDS WITH THE NUMBER OF THE HOLE ON THE EXPANDER BOARD AS YOU CONNECT EACH ONE.

( ) In the same manner as the connections above, connect the free end of the 4 24-inch wires with terminal lugs attached to holes number 1, 2, 50 and 52.

( )*In the same manner, install cable clamps on the two screws on the left side of the board and route the other four wires through these.



8800 M/BD
EXPANDER
BOARD
WIRING



BOARD INSTALLATION

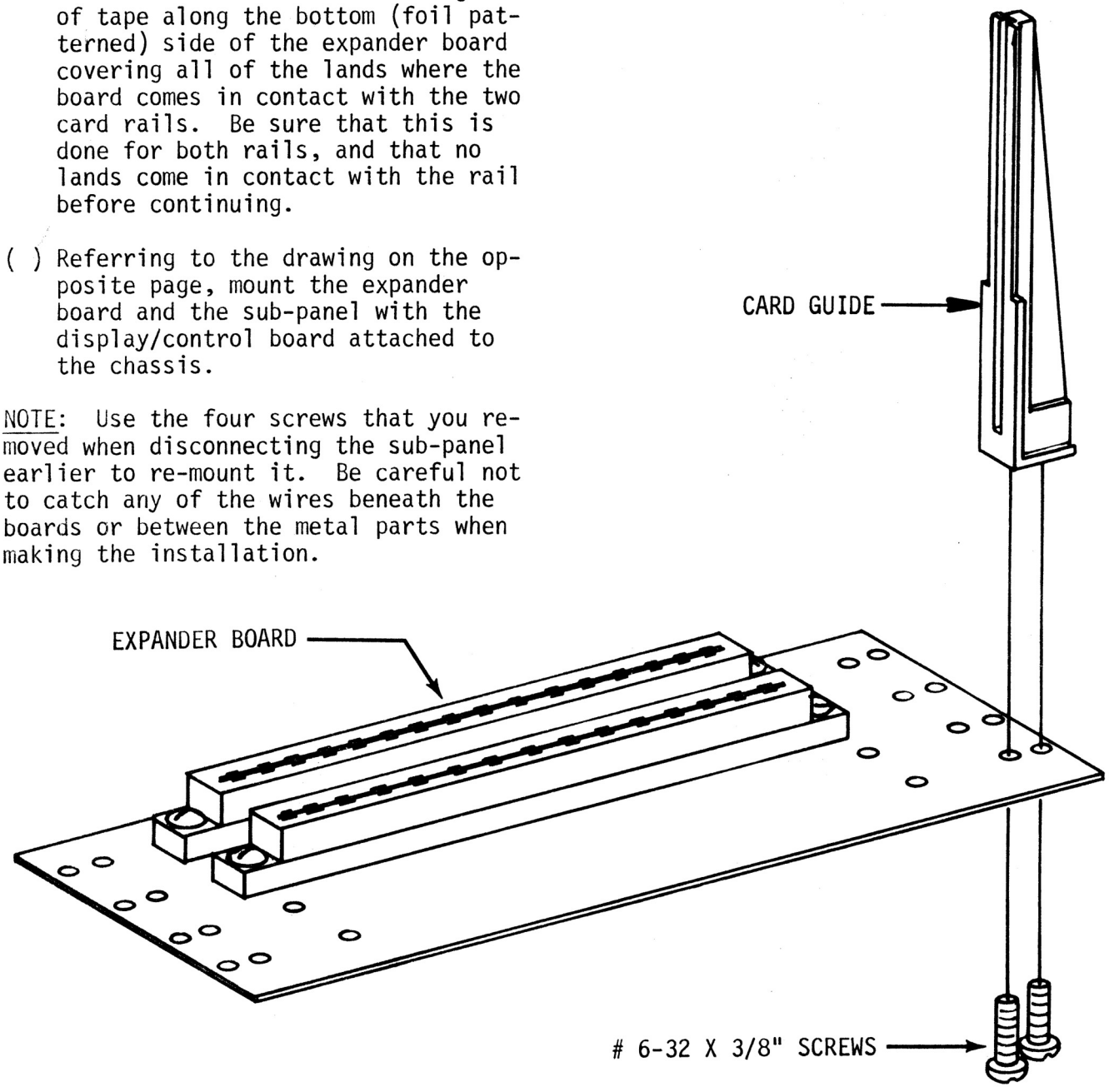
The expander board and the display/control board can now be mounted onto the chassis.

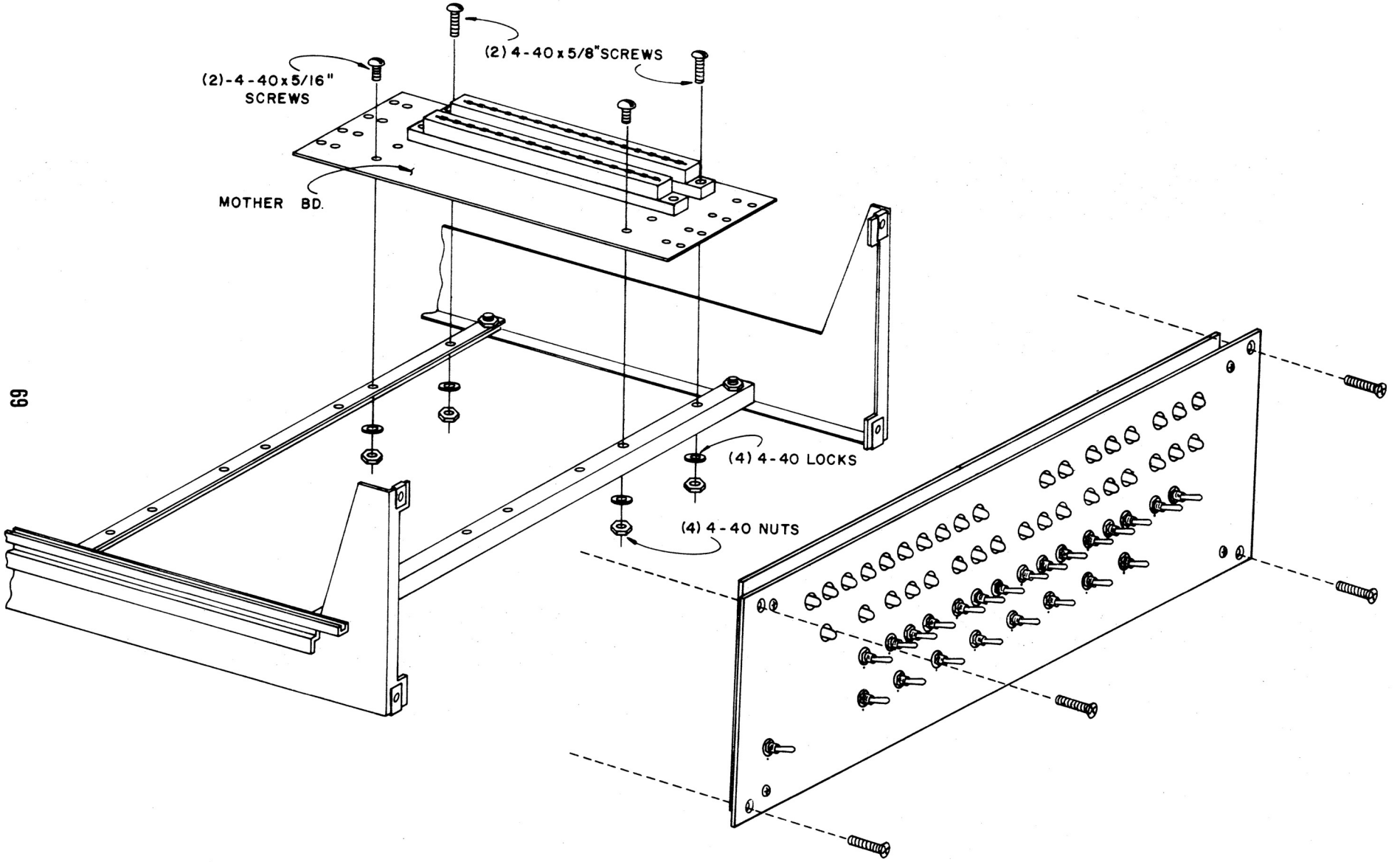
(✓) Before mounting the expander board, refer to the drawing on the opposite page and set the board in place on the card rails. Observe where the board comes in contact with the rails themselves. Place a length of tape along the bottom (foil patterned) side of the expander board covering all of the lands where the board comes in contact with the two card rails. Be sure that this is done for both rails, and that no lands come in contact with the rail before continuing.

( ) Referring to the drawing on the opposite page, mount the expander board and the sub-panel with the display/control board attached to the chassis.

NOTE: Use the four screws that you removed when disconnecting the sub-panel earlier to re-mount it. Be careful not to catch any of the wires beneath the boards or between the metal parts when making the installation.

(✓) Install card guides into the pairs of holes along the outside edges of the expander board as shown below. Install them in the holes corresponding to each of the edge connectors you have previously installed.




(2) 4-40 x 5/8" SCREWS
(2)-4-40 x 5/16" SCREWS
MOTHER BD.
(4) 4-40 LOCKS
(4) 4-40 NUTS

BUS POWER CONNECTIONS

There are 7 wires with terminal lugs attached to be connected to the terminal block.

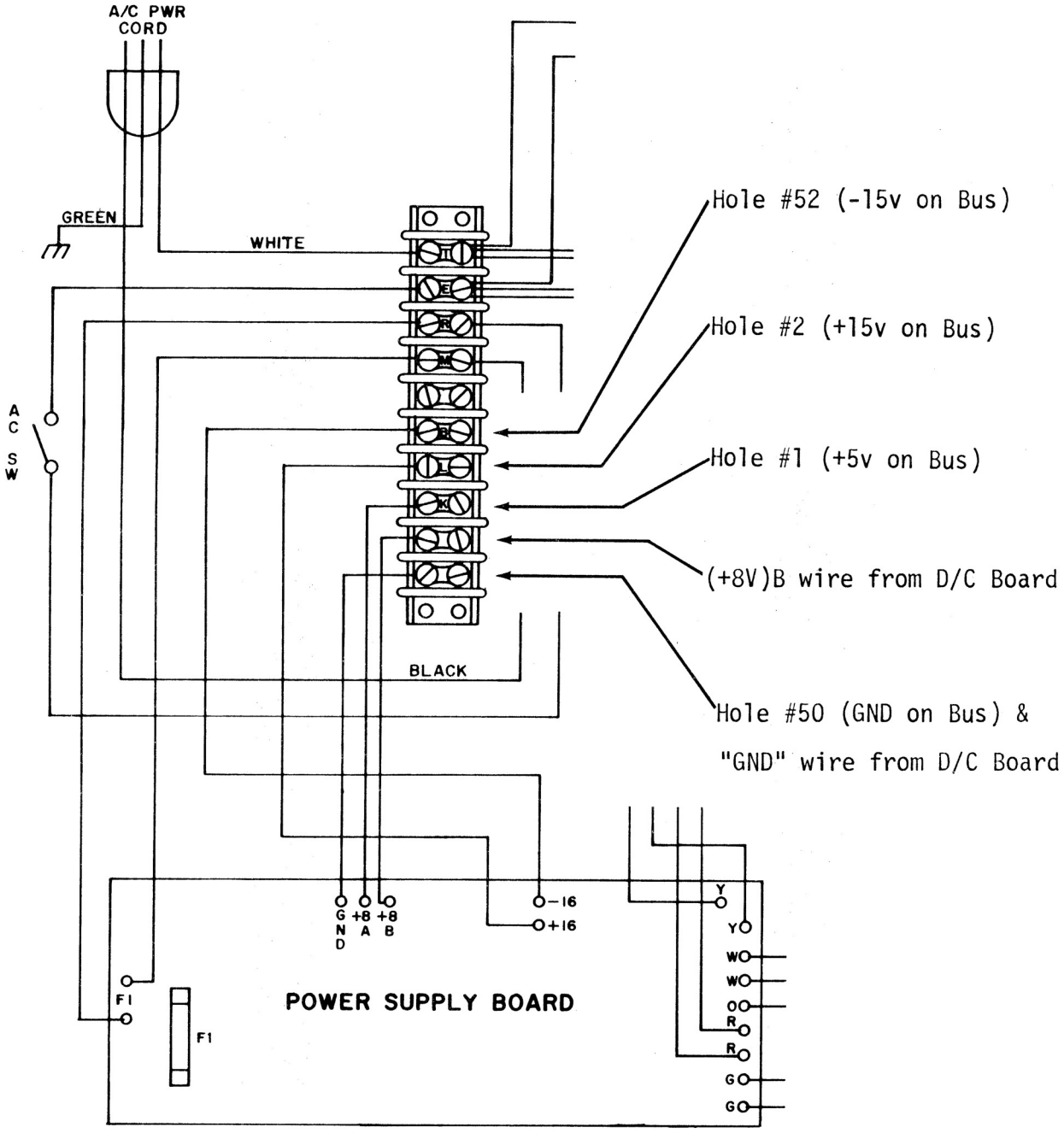
( ) Referring to the drawing on the opposite page, connect the four 24 inch wires from holes 1, 2, 50 and 52 on the expander board to the terminal block as shown. Be sure to place them in the exact location indicated.

( ) Refer to the drawing again and connect the two "AC SW" wires and the "GND" and "(+8V)B" wires from the display/control board to the terminal block as shown.

NOTE: It is very important that all of these wires be in the exact locations indicated by the instructions as they provide all of the power to the boards in the unit. Refer to the bus structure chart on page 72 for a complete description of all of the signals and their location on the bus.

NOTE: The 4 wires from the expander board should be routed around the right side of the case. The 4 wires from the Display/Control board should be routed around the left side of the case.

Some additional cable clamps are included with your kit to aid in routing these wires. These may be attached to the card rail mounting screws and the top row of holes along the sides of the chassis as necessary.


A/C PWR CORD
GREEN
WHITE
BLACK
A C S W
Hole #52 (-15v on Bus)
Hole #2 (+15v on Bus)
Hole #1 (+5v on Bus)
(+8V)B wire from D/C Board
Hole #50 (GND on Bus) &
"GND" wire from D/C Board
GND
+8A
+8B
-16
+16
Y
Y
W
W
O
R
R
G
G
F1
F1
POWER SUPPLY BOARD

8800 BUS STRUCTURE

1	+5 V
2	+15 V
3	XRDY
4	VI ø
5	VI 1
6	VI 2
7	VI 3
8	VI 4
9	VI 5
10	VI 6
11	VI 7
12	
13	
14	
15	
16	
17	
18	$\overline{\text{STAT DISABLE}}$
19	$\overline{\text{C/C DISABLE}}$
20	UNPROTECT
21	SS
22	$\overline{\text{ADDR DSBL}}$
23	$\overline{\text{DO DSBL}}$
24	ø2
25	ø1
26	PHLDA
27	PWAIT
28	PINTE
29	A5
30	A4
31	A3
32	A15
33	A12
34	A9
35	DO 1
36	DO ø
37	A10
38	DO4
39	DO5
40	DO6
41	DI 2
42	DI 3
43	DI 7
44	SM1
45	SOUT
46	SINP
47	SMEMR
48	SHLTA
49	CLOCK (2 MHz)
50	GND

51	+5 V	A
52	-15 V	B
53	$\overline{\text{SSW DSB}}$	C
54	$\overline{\text{EXT CLR}}$	D
55		E
56		F
57		H
58		J
59		K
60		L
61		M
62		N
63		P
64		R
65		S
66		T
67		U
68	MWRITE	V
69	$\overline{\text{PS}}$	W
70	PROTECT	X
71	RUN	Y
72	PRDY	Z
73	$\overline{\text{PINT}}$	a
74	$\overline{\text{PHOLD}}$	b
75	$\overline{\text{PRESET}}$	c
76	PSYNC	d
77	$\overline{\text{PWR}}$	e
78	PDBIN	f
79	A ø	h
80	A 1	j
81	A 2	k
82	A 6	l
83	A 7	m
84	A 8	n
85	A 13	p
86	A 14	r
87	A 11	s
88	DO 2	t
89	DO 3	u
90	DO 7	v
91	DI 4	w
92	DI 5	x
93	DI 6	y
94	DI 1	z
95	DI ø	AA
96	SINTA	AB
97	SWO	AC
98	SSTACK	AD
99	$\overline{\text{POC}}$	AE
100	GND	AF

INTERCONNECTIONS AND BOARD INSTALLATIONS

The CPU and Memory boards can now be installed into the unit.

( ) The 8080 CPU integrated circuit can now be placed into its socket on the CPU Board. Before proceding, go back and review the "MOS IC Special Handling Precautions" in the front of this manual.

( ) Insert the 8080 IC into its socket. Be very careful in handling it and use as little pressure as possible when inserting it.

( ) Press the 8800 CPU Board into the first edge connector, with the silk-screened side of the board facing towards the chassis. This should place the wafer connector on the CPU Board towards the back of the unit.

( ) Referring to the drawing on the opposite page, connect the Connector Plug from the display/control board to the Wafer Connector on the CPU board as indicated. Be sure that the signals match as indicated.

( ) Insert the Memory board into the second edge connector in the same manner as the CPU Board. It should be oriented so that the silk-screened side of the board is towards the CPU Board.

8800 GROUNDING MODIFICATION

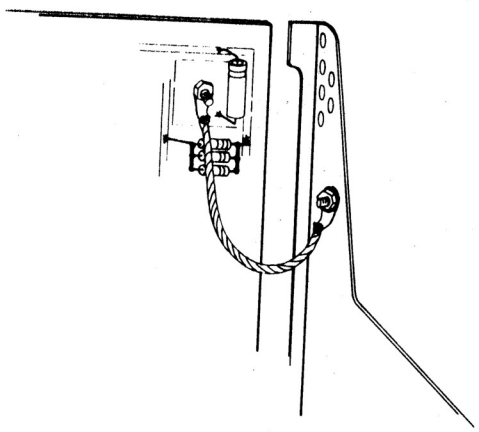
There are several grounding straps to be added between various members of the chassis and some of the PC boards.

There are two sizes of braided wire provided in your kit for making these connections, 1/8 inch and 1/4 inch. The 1/4 inch size is used along the edge of the power supply board and the 1/8 inch is used to make all other connections.

The first connection is to be made between the display/control board and the chassis.

( ) Cut a length of the 1/8 inch braid approximately 3 inches and solder a solder lug in place on each end.

( ) Referring to the drawing below, attach the braid between the 7805 mounting screw on the back side of the display/control board and the chassis as shown.

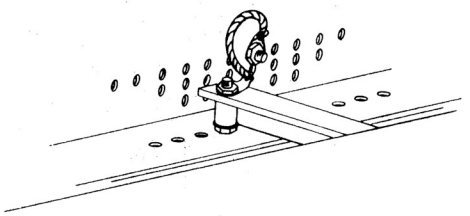


NOTE: At any point where a connection is made to the chassis, first rub the area around the connection point with sandpaper or some other abrasive to remove the anodizing.

This connection should be insulated using heat-shrink or some other such tubing.

( ) Prepare another length of 1/8 inch braid in exactly the same manner as the first piece.

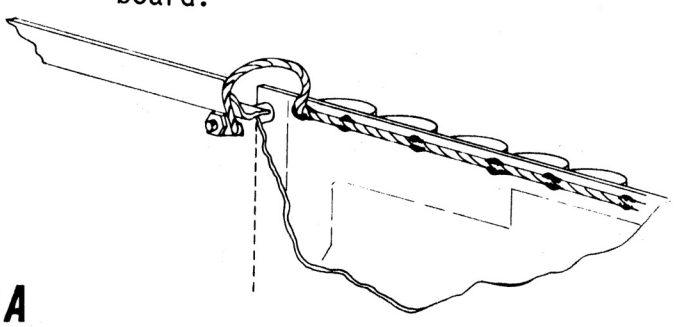
( ) Connect this braid between the card rail towards the back of the unit on the side opposite the transformers and the chassis as shown in the drawing below.



( ) The 1/4 inch braid is to be soldered directly to the PC land on the bottom (non silk-screened) side of the power supply board. Solder this braid in place along its entire length between the negative side of C1 and the positive side of C14. (see drawing below)

( ) Prepare a 4 inch length of 1/8 inch braid by attaching a solder lug to one end.

( ) Solder the end opposite the lug on the 4 inch length to the end of the 1/4 inch braid beneath capacitor C1 as shown in the drawing below. The end of the 1/8 inch braid with the solder lug will be attached to the bottom side of the cross member with the same screw which mounts the closest corner of the power supply board.



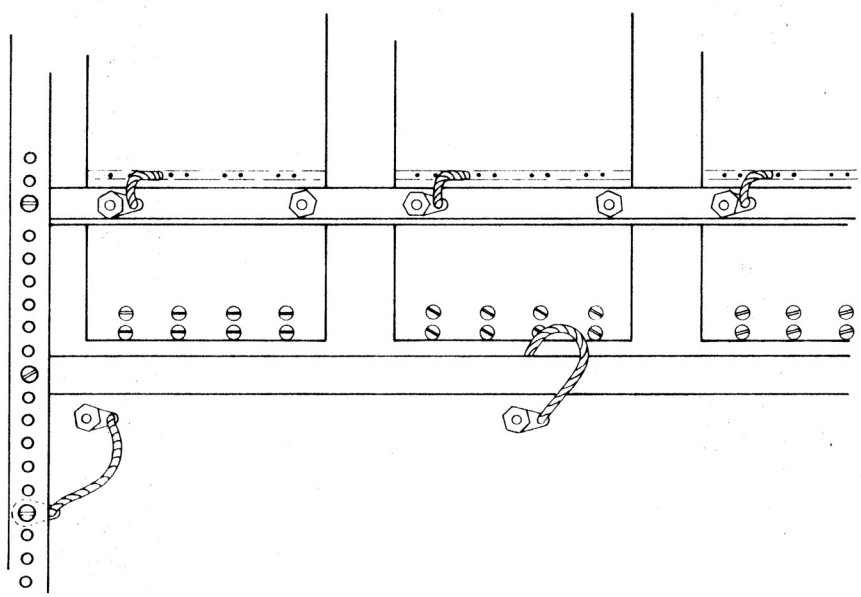
( ) Prepare another 3 inch length of 1/8 inch braid by attaching solder lugs to each end.

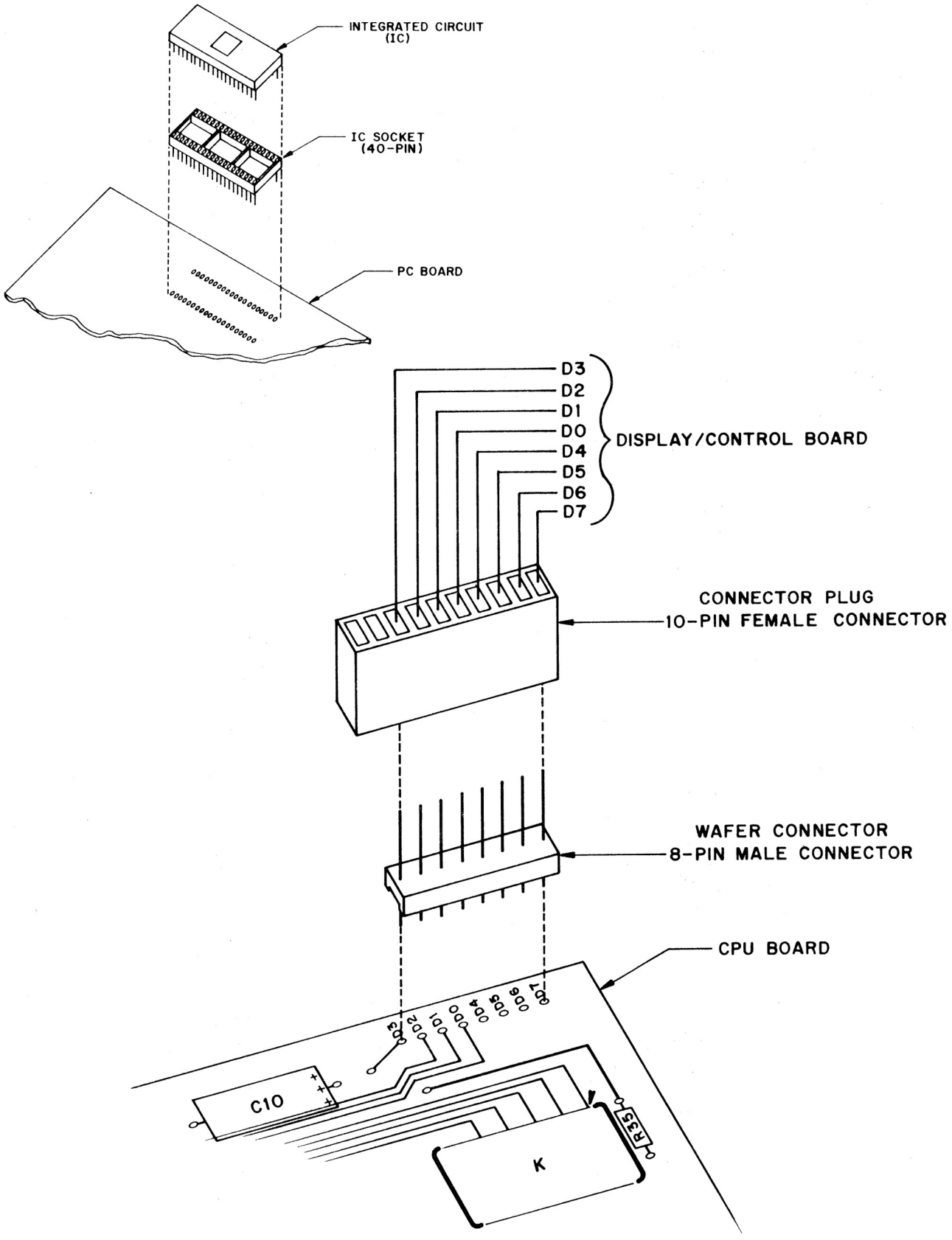
( ) Connect this length of braid between the cross member on the side opposite the transformers and the chassis as shown in the drawing below.

NOTE: The drawing below also shows the 4 inch length of braid from the power supply board properly attached to the cross member as previously instructed.

( ) Prepare a 3 inch length of 1/8 inch braid for each of the expander boards in your kit by attaching a solder lug to one end.

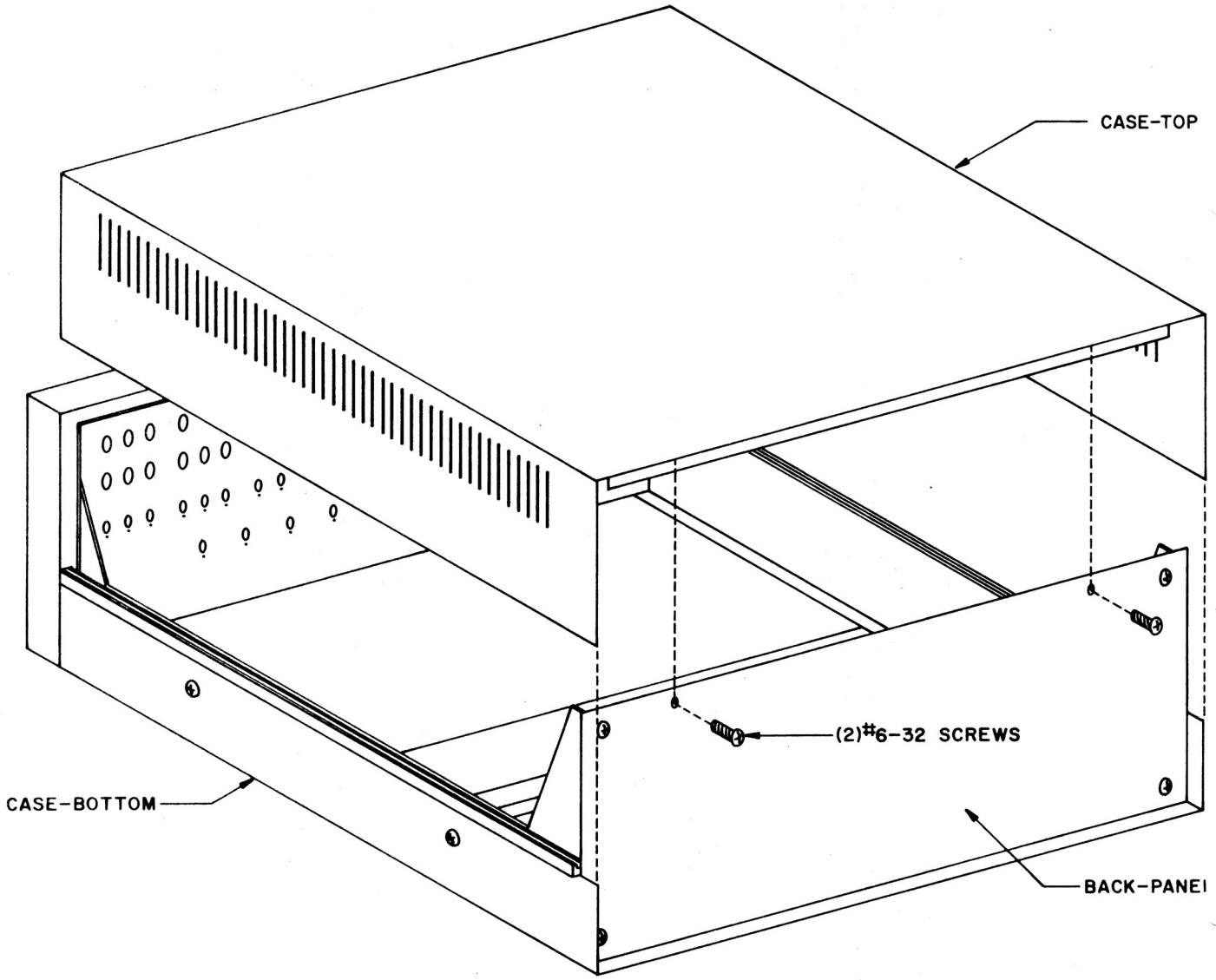
( ) Connect these wires between the card rail and the expander boards as shown in the drawing below. The end of the braid opposite the lug should be soldered directly to the land on the expander board which runs along the edge connecting pins 50 and 100 of each connector. Be very careful not to create any solder bridges when making this connection.




INTEGRATED CIRCUIT
(IC)
IC SOCKET
(40-PIN)
PC BOARD
D3
D2
D1
D0
D4
D5
D6
D7
DISPLAY/CONTROL BOARD
CONNECTOR PLUG
10-PIN FEMALE CONNECTOR
WAFER CONNECTOR
8-PIN MALE CONNECTOR
CPU BOARD
C10
R35
K

CASE TOP INSTALLATION

The chassis and the case top should be re-installed into the case bottom in the same manner as they were removed. Use the same hardware which you removed earlier to re-assemble the unit.



NAME PLATE INSTALLATION

The MITS ALTAIR 8800 COMPUTER name plate is to be installed after the entire case has been re-assembled.

WARNING: The adhesive backing on the Altair name plate is extremely strong. Take extra precaution when installing it to be sure that you place it in the correct position the first time.

( ) Remove the paper covering from the back of the name plate. Be careful not to touch anything to the adhesive while you have the paper removed.

( ) Attach the plate to the dress panel on the very bottom, beneath the switches. Be sure that the dress panel is tight against the case bottom before doing this, as the plate will not fit between the panel and the case.

*****ERRATA SHEET*****

THE FOLLOWING CHANGES ARE TO BE MADE TO THE PAGES INDICATED IN THE ASSEMBLY MANUAL. BE SURE TO READ THESE OVER CAREFULLY.

PAGE 26: There will be a 24-pin IC socket provided for IC K. This is to be installed in the same manner as the 40-pin socket. The socket for this IC may be of a different type. If it does not appear similar to the 40-pin socket it will be the "AMP" type socket. This will require you to separate it into two halves by cutting away the 4 cross pieces between the two 12-pin sides. Install each half in the same manner as the 40-pin socket.

PAGE 34: The 2 MHz crystal provided with your kit may not be provided with the cardboard container indicated in the instructions. In this case, use a piece of masking or electrical tape to wrap the metal body of the crystal to insulate it from the board.

PAGE 54: Before installing the transformers, cut the following wires off at a point near where they enter the coil winding:

T1---cut off the YELLOW wire

T2---cut off the 2 BLUE wires

T3---cut off the YELLOW/GREEN stripped wire

When installing the transformers, orient them so that the primary leads (black wires) are as follows:

T1---primary downward

T2---primary upward

T3---primary towards the left

PAGE 60: The Power Supply Board is to be mounted to the cross member using #6-32 X 3/4 inch screws instead of the 5/8 inch screws indicated in the drawing.

PAGE 60: (cont.) There are now two screens to be mounted on the back panel. The screen shown in the drawing has been split so that there is one for the fan opening and one for the connector openings on the left. The fan opening screen is mounted using #6-32 screws and the other screen using #4-40 screws. Add lockwashers to all of the screen mounting screws between the nuts and the flatwashers.

PAGE 68: Before installing the sub-panel, use a couple layers of plastic electrical tape to insulate the "AC SW" wire leads and the switch leads themselves (S8) at the points where they enter the board. These points will have 110VAC on them so insulating them will add an additional safety factor for handling.

PAGE 66: & PAGE 70 Your kit contains 6 cable clamps. Two should be mounted on the Display/Control Board itself; one as in the drawing on page 67 and the other on the corner diagonally opposite the one in the drawing.

Three clamps should be mounted on the card rail mounting screws; one on the rail closest to the D/C board on the right and the other two on both rails on the left side.

The last clamp should be mounted on the chassis itself in the last hole closest to the back on the left side.

Route the wires through these clamps as indicated in the instructions.

8800 CPU Board
Parts List
7 February 1975

S/N 100125 OK

BAG 1

1	8080	101070	Q/C
1	8212	101071	
9	8T97	101040	
1	74L00	101080	
1	74L02	101072	
1	7404	101022	
1	74LS04	101042	
1	7406	101054	
1	74L74	101063	
1	74123	101060	
1	mA7805	101074	

BAG 2

1	CS4410		102806
1	5.1v Zener		100721
1	12v Zener		100722

BAG 3

22	1K	1/2w	101928

BAG 4

2	330	1/2w	101926
4	470	1/2w	101927
1	680	1/2w	102099
8	4.7k	1/2w	101930
1	6.2k	1/2w	101943
1	13k	1/2w	101974
1	20k	1/2w	101940
2	47k	1/2w	101934
1	33ohm	2w	101964
1	220ohm	2w	101963

BAG 5

1	10pF	16v	100301
1	20pF	10v	100334
1	100pF	16v	100361
1	0.01uF	16v	100321
4	35uF	15v	100333

BAG 6

24	0.1uF	16v	100327

BAG 7

1	6-32x1/4 screw	100917
1	6-32 nut	100933
1	#6 lockwasher	100942
1	2.000 MHz crystal	101855
1	8-pin wafer connector	101866
1	40 pin socket	102106
1	24 pin socket	102105
1	16" white wire	103048
1	heat sink	101870

MISC.

1	8800 CPU BD PC Board	100161

8800 1K Stat Mem
Parts List
February 7, 1975

S/N 150 1251K

BAG 1

2	8T97	101040
4	74LØØ	101080
1	7404	101022
2	74L04	101073
1	74L30	101082
1	7432	101083
1	74L73	101084
2	8101	101050
1	uA7805	101074

BAG 2

21	.1uF	16v	100327
2	35uF	15v	100333

BAG 3

1	6-32 x 1/4	screw	100917
1	6-32	nut	100933
1	#6	lockwasher	100942
1	4 5/8" white	wire	103011
1	heat sink		101870

MISC.

1	8800 1K Stat Mem Bd	PC Board	100162

8800 P/S Board
Parts List
February 7, 1975

S/N _____

BAG 1

1	470 1/2W	101927
1	1K 1/2W	101928
2	4.7K 1/2W	101930
10	IN4004	100718
1	VJ048	100711

BAG 2

1	strain relief	101719
2	small rubber feet	101751
1	3AG 1AMP 250v fuse	101773
2	3AG fuse clips	101726
	fuse cover	n/a
6ft	AWG #20 wire	103062
17	2106-06-00 solder lug	101801
1	10-141 terminal bloc	101868
1	wire (H.D. Buss-12")	103056

MISC.

1	133-P-5 transformer	102602
1	Programmer 110v transformer	102609
1	P-6138 transformer	102611
1	8800 P/S Bd PC Board	100167
1	6' - 3 wire power cord	101742

BAG 3

5	6-32X1/2 screw	100918
17	6-32 nut	100933
5	#6 flat wash	100943
17	#6 lock wash	100942
4	.25" spacer	101826
16	6-32X3/8 screw	100925
4	6-32X5/8 screw	100916
2	4-40X5/16 screw	100912
2	4-40X1/4	100910
6	4-40 nut	100932
6	#4 lockwasher	100941
4	4-40X3/8 screw	100908
4	#4 flat washer	100940
4	8-32X3/8 screw	100928
4	8-32 nut	100929
4	#8 lockwasher	100945
5	6-32X3/4 screw	100935
1	.125 metal spacer	101827
4	.375 metal spacer	101828

BAG 4

5	0.1uF 16v	100327
2	0.1uF 50v	100312
1	500uF 25v	100318
1	2200uF 25v	100375
6	3300uF 16v	100315

8800 D/C Control Board
Parts List
February 7, 1975

S/N 501252K

BAG 1

3	7400	101020
1	74L02	101072
2	7404	101022
1	74L04	101073
2	74LS04	101042
5	7405	101052
2	74L10	101081
1	7430	101059
1	74L30	101082
1	7473	101027
5	74123	101060
1	8T97	101040
1	uA7805	101074

BAG 2

1	100 1/2W	101924
11	1K 1/2W	101928
4	7.5K 1/2W	101992
3	30K 1/2W	102089
3	47K 1/2W	101934
1	270K 1/2W	101935
1	20K 1/2W	101940
3	68ohm 1/2W	101923

BAG 3

36	220 1/2W	101925

BAG 4

27	.1uF 16v	100327

BAG 5

1	0.01uF 500v	100304
1	0.001uF 1Kv	100328
4	20pF 10v	100334
1	33uF 16v	100326

BAG 6

36	RL - 21 LED	100702

BAG 7

17	SPDT; ST1-1-C toggle sw	102366

BAG 8

8	SPDT, MOM centr off; ST1-3-C toggle sw	102367

BAG 9

59	AWG #26 3' white wire	103060
4	AWG #20 3' orange wire	103061

BAG 10

1	heat sink	101870
4	2106-06-00 solder lug	101801
1	cable clamp 7/16"	103022
1	6-32X1/4 screw	100917
1	6-32X1	100919
3	6-32X1 1/4	100920
5	6-32 nut	100933
5	#6 lockwasher	100942
4	0.6" spacer	101824
1	10 pin plug	101768
8	terminals for 10 pin plug	101769

MISC.

1	8800 D/C Bd PC Board	100163

8800 Expander Card
Parts List
February 7, 1975

S/N _____

BAG 1

2	3VH50/1CV5	edge connector	101864
2	4-40x5/8	screw	100904
2	4-40x5/16	screw	100912
4	4-40	nut	100932
4	#4	lockwasher	100941
4	AWG #20 2'	wire	103063
4	2106-06-00	solder lug	101801

MISC.

1	8800EC	PC Board	100164

8800 Case
Parts List
February 7, 1975

S/N _____

BAG 1

8	6-32x3/4"	screw	100935
20	6-32	nut	100933
12	#6	lockwasher	100942
12	#6	flat washer	100943
8	0.25"	spacer	101826
4		card guide	101714
4	6-32x1/2"	screw	100918

4	4-40x5/8"	screw	100904
4	4-40	nuts	100932
4	4-40	lockwasher	100941
4	4-40	flat washer	100940

MISC.

1	2290 17"	case	100505
2		card rails	101867
1	type A	screen	101740
1	type B	screen	101741
1	8800 name plate		101759